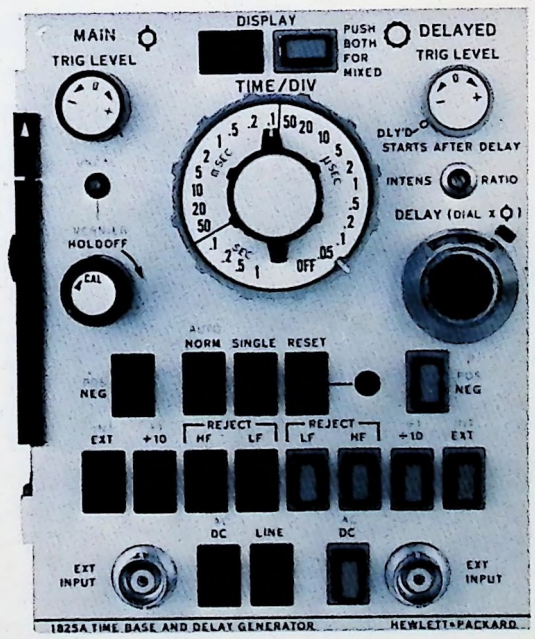
OPERATING AND SERVICE MANUAL

TIME BASE AND DELAY GENERATOR

1825A



HEWLETT hp PACKARD

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

C W&A 6/74

OPERATING AND SERVICE MANUAL

MODEL 1825 A
TIME BASE AND DELAY GENERATOR

SERIALS PREFIXED: 1348A

Refer to Section VII for instruments with other Serial Prefixes.

HEWLETT-PACKARD COMPANY/COLORADO SPRINGS DIVISION
1900 GARDEN OF THE GODS ROAD, COLORADO SPRINGS, COLORADO, U.S.A.

Manual Part Number 01825-90902.
Microfiche Part Number 01825-90802.

PRINTED: NOV 73

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SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual provides operating and service information for the Hewlett-Packard Model 1825A Time Base and Delay Generator (figure 1-1). The manual is divided into eight sections, each covering a specific topic or aspect of the instrument. All schematics are located at the rear of the manual and can be unfolded and used for reference while reading any part of the manual.

1-3. This section contains a description of Model 1825A. The instrument specifications are listed in table 1-1. Table 1-2 lists and describes the abbreviations used everywhere in this manual except Section VI. The parts list in Section VI is a computer readout and uses computer-supplied abbreviations.

1-4. DESCRIPTION.

1-5. Model 1825A is designed for use in HP 180-series mainframes and provides sweep speeds ranging from 0.05 microsecond per division to 1 second per division in 23 ranges. Delay times are continuously variable from 50 nanoseconds to 10 seconds and are accurate to ± 1%. A calibrated mixed sweep mode is also provided. A mainframe X10 magnifier provides sweep speeds to 5 nanoseconds per division with 5% accuracy.

1-6. Stable triggering is accomplished with one knob control for main, delayed, and mixed modes. Stable, accurate time displays are provided in all three modes from a 50-millivolt trigger to 50 megahertz. The trigger requirement increases to 150 millivolts at 150 megahertz.

1-7. Front panel controls are logically arranged. Pushbuttons are used to reduce the possibility of errors and to make it easier to establish main, delayed, and mixed modes.

1-8. Trigger level controls on main and delayed sweeps allow selection on the desired portion of the display for most measurement applications. The ÷ 10 function provides a wider dynamic range of triggering in both internal and external modes of operation.

1-9. External trigger sensitivity of 50 millivolts on both main and delayed sweeps allows a 10:1 divider probe to be used with 0.5-volt logic circuits, reducing the possibility of circuit loading at trigger pickoff points. This reduces the possibility of circuit malfunction caused by the measuring instrument.

1-10. WARRANTY.

1-11. The instrument is certified and warranted as stated on the inside front cover of this manual.

CAUTION

The warranty may be void for instruments having a missing or mutilated serial number tag.

1-12. AVAILABLE ACCESSORIES.

1-13. A complete line of test probes, connectors, adaptors, and other accessory items is available from Hewlett-Packard. For information on specific items, refer to the HP catalog or contact the nearest HP Sales/Service Office.

1-14. INSTRUMENT AND MANUAL IDENTIFICATION.

1-15. This manual applies directly to Model 1825A instruments having a serial prefix number as listed on the manual title page. The serial prefix number is the first group of digits in the instrument serial number (figure 1-2). The instrument serial number is located on a tag on the rear of the instrument.

1-16. Check the serial prefix number of the instrument. If the serial prefix number is different from that listed on the title page of this manual, refer to Section VII for instructions to adapt this manual for proper instrument coverage.

1-17. Errors in this manual are listed under errata on an enclosed MANUAL CHANGES sheet (if any).

1-18. INQUIRIES.

1-19. Refer any questions regarding the manual, the change sheet, or the instrument to the nearest HP Sales/Service Office. Always identify the instrument by model number, complete name, and complete serial number in all correspondence. Refer to the inside rear cover of this manual for a world-wide listing of HP Sales/Service Offices.

Table 1-1. Specifications

MAIN TIME BASE

SWEEP

RANGES: 0.05 usec/div to 1 sec/div (23 positions) in 1, 2, 5, sequence. ±3% accuracy with vernier in calibrated position.
VERNIER: continuously variable between ranges, extends slowest sweep to at least 2.5 sec/div. Uncalibrated light indicates when vernier not in CAL position.
MAGNIFIER: (on mainframe) expands fastest sweep to 5 ns/div.

SWEEP MODE

NORMAL: sweep is triggered by internal, external or power line signal.
AUTOMATIC: bright baseline displayed in absence of trigger signal. Triggering is same as normal except low frequency limit is 40 Hz.
SINGLE: in normal, sweep occurs once with same triggering as normal; reset pushbutton arms sweep and lights indicator; in auto, sweep occurs once each time reset pushbutton is pressed.

DELAY

TIME: continuously variable from 50 ns to 10 sec.
ACCURACY: ±0.75% of differential delay ±2 minor divisions of delayed dial.
TIME JITTER: 0.002% (1 part in 50,000) of maximum delay on each range.

DELAYED TIME BASE

SWEEP

RANGES: 0.05 usec/div to .20 ms/div (19 positions) in 1, 2, 5 sequence. ±3% accuracy.
MAGNIFIER: (on mainframe) expands fastest sweep to 5 ns/div.

TRIGGERING

SOURCE

INTERNAL: refer to vertical amplifier plug-in specification.
EXTERNAL: dc to 50 MHz on signals 50 mV p-p or more increasing to 100 mV at 100 MHz and 150 mV at 150 MHz.
LINE: (main sweep only) power line frequency signal.

LEVEL

INTERNAL: at any point on the vertical waveform displayed.
EXTERNAL: continuously variable from +2V to −2V on either slope of trigger signal; in ÷ 10 setting, from +20V to − 20V.

COUPLING

DC: direct coupling.
AC: capacitive coupling, attenuates signals below approx 20 Hz.
HF REJECT: attenuates signals above approx 15 kHz.
LF REJECT: attenuates signals below approx 15 kHz.

SLOPE

POSITIVE: positive slope of trigger signal initiates sweep.
NEGATIVE: negative slope of trigger signal initiates sweep.

TRIGGER HOLDOFF

Time between sweeps continuously variable, exceeding one full sweep on all ranges (main sweep only).

DELAY TRIGGER

Delayed time base is triggered on first triggering pulse after set delay (set by main time base and and delay controls) or automatically triggers after set delay when delayed level control is in detent position.

TRACE INTENSIFICATION

In main sweep mode, intensifies that part of main time base to be expanded to full screen in delayed time base mode. In mixed mode, intensifies that part of main time base to be completed by delayed time base. Rotating time base switch from OFF position activates intensified mode.

CALIBRATED MIXED SWEEP

Combines main and delayed sweeps into one display. Sweep is started by main time base and is completed by faster delayed time base. Delayed sweep start is aligned with start of intensified marker.

GENERAL

WEIGHT

Net, 4 lb (1, 8 kg); shipping, 7 lb (3, 1 kg).

ENVIRONMENT

TEMPERATURE: 0° to +55° C.

HUMIDITY: to 95% relative humidity to 40° C.

ALTITUDE: to 15,000 ft.

VIBRATION: vibrated in three planes for 15 min each with 0.010 in. excursion, 10 to 55 Hz.

Table 1-2. Reference Designators and Abbreviations

REFERENCE DESIGNATORS

A	ASSEMBLY	E	MISC. ELECTRICAL PART	P	PLUG	U	INTEGRATED CIRCUIT (UNREPAIRABLE)
AT	ATTENUATOR RESISTIVE TERMINATION	F	FUSE	PS	POWER SUPPLY	V	VACUUM TUBE, NEON BULB, PHOTOCELL, ETC.
B	MOTOR, FAN	FL	FILTER	Q	TRANSISTOR	VR	VOLTAGE REGULATOR (DIODE)
BT	BATTERY	H	HARDWARE	R	RESISTOR	W	CABLE
C	CAPACITOR	J	JACK	RT	THERMISTOR	X	SOCKET
CP	COUPLING	K	RELAY	S	SWITCH	Y	CRYSTAL
CR	DIODE	L	INDUCTOR	T	TRANSFORMER	Z	NETWORK
DL	DELAY LINE	LS	SPEAKER	TB	TERMINAL BOARD		
DS	DEVICE SIGNALING (LAMP)	M	METER	TP	TEST POINT		
		MP	MECHANICAL PART				

ABBREVIATIONS

A	AMPERE(S)	F	FARAD(S)	n	NANO (10^{-9})	rfi	RADIO FREQUENCY INTERFERENCE
A	AMPERE TURN(S)	FET	FIELD-EFFECT TRANSISTOR(S)	nc	NORMALLY CLOSED	rms	ROOT MEAN SQUARE
ampl	AMPLIFIER(S)	G	GIGA (10^{9})	no.	NORMALLY OPEN	rwv	REVERSE WORKING VOLTAGE
assy	ASSEMBLY	gnd	GROUND(ED)	npn	NEGATIVE-POSITIVE-NEGATIVE	SCR	SILICON CONTROLLED RECTIFIER
ampltd	AMPLITUDE	H	HENRY(IES)	ns	NANOSECOND	sec	SECOND(S)
bd	BOARD(S)	hr	HOUR(S)	p	PICO (10^{-12})	std	STANDARD
bp	BANDPASS	HP	HEWLETT-PACKARD	pc	PRINTED (ETCHED) CIRCUIT(S)	trmr	TRIMMER
c	CENTI (10^{-2})	Hz	HERTZ	pk	PEAK	u	MICRO (10^{-6})
C	CARBON	if.	INTERMEDIATE FREQ.	pnp	POSITIVE-NEGATIVE-POSITIVE	usec	MICROSECOND
ccw	COUNTERCLOCKWISE	intl	INTERNAL	p/o	PART OF	V	VOLTS
coax.	COAXIAL	k	KILO (10^{3})	p-p	PEAK-TO-PEAK	var	VARIABLE
coef	COEFFICIENT	lb	POUND(S)	prgm	PROGRAM	w/	WITH
com	COMMON	lpf	LOW-PASS FILTER(S)	prv	PEAK INVERSE VOLTAGE(S)	w/o	WITHOUT
CRT	CATHODE-RAY TUBE	m	MILLI (10^{-3})	ps	PICOSECOND	wiv	WORKING INVERSE VOLTAGE
cw	CLOCKWISE	M	MEGA (10^{6})	pwv	PEAK WORKING VOLTAGE		
d	DECI (10^{-1})	ms	MILLISECOND	rf	RADIO FREQUENCY		
dB	DECIBEL						
ext	EXTERNAL						

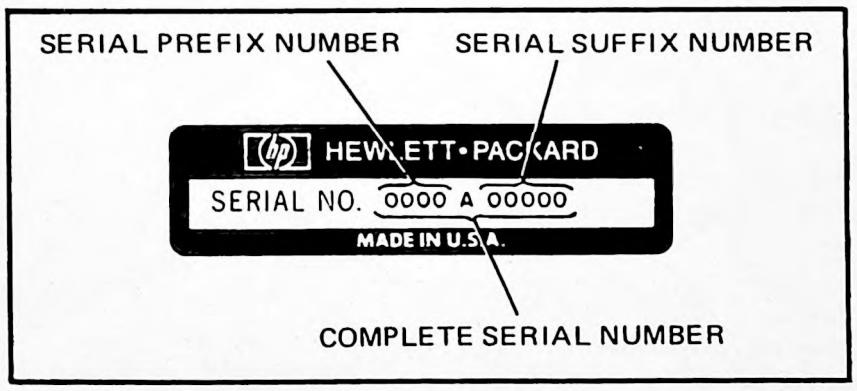


Figure 1-2. Instrument Serial Number

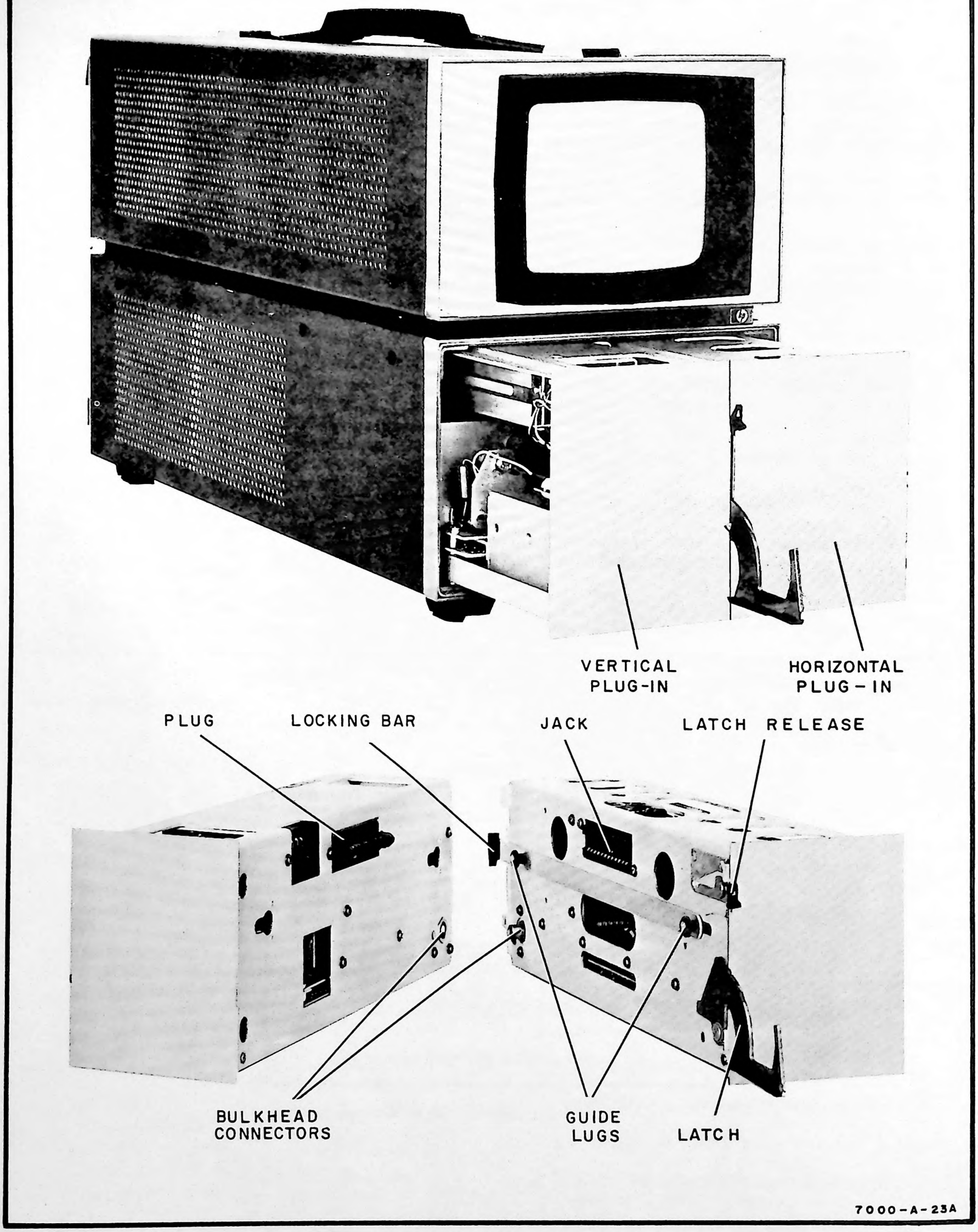


Figure 2-1. Plug-in Mating

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains instructions for performing an initial inspection of Model 1825A. Installation procedures and precautions are presented in step-by-step order. The procedures for making a claim for warranty repairs and for repacking the instrument for shipment are also described in this section.

2-3. INITIAL INSPECTION.

2-4. The instrument was inspected mechanically and electrically before shipment. Upon receipt, inspect it for damage that may have occurred in transit. Check for broken knobs, bent or broken connectors, and dents or scratches. If damage is found, refer to the claims paragraph in this section. Retain the packing material for possible future use.

2-5. Check the electrical performance of the instrument immediately after receipt. Refer to Section V for the performance check procedure. The performance check will determine whether or not the instrument is operating within the specifications listed in table 1-1. Initial performance and accuracy of the instrument are certified as stated on the inside front cover of this manual. If the instrument does not operate as specified, refer to the claims paragraph in this section.

2-6. INSTRUMENT MOUNTING.

2-7. Model 1825A and the vertical plug-in must be locked together before being inserted into the plug-in compartment of a 180-series oscilloscope mainframe. Power for Model 1825A is supplied by the mainframe.

2-8. To install Model 1825A and the vertical plug-in, proceed as follows:

a. Move locking bar to rear (see figure 2-1).

b. Mate vertical plug and horizontal jack, making certain bulkhead connectors and guide lugs are aligned and press two plug-ins firmly together.

c. After ensuring that front and rear panels are aligned, push locking bar forward.

d. Lift up on latch release and rotate latch downward.

e. Slide plug-ins into plug-in compartment in mainframe.

f. Rotate latch upward and push in to lock.

2-9. INSTRUMENT COMPATIBILITY.

2-10. Model 1825A will mate with any vertical plug-in in the 180-series and will operate in any mainframe in the series.

2-11. CLAIMS.

2-12. The warranty statement applicable to this instrument is printed inside the front cover of this manual. If physical damage is found or if operation is not as specified when the instrument is received, notify the carrier and nearest HP Service Office immediately (refer to the list in back of this manual for addresses). The HP Sales/Service Office will arrange for repair or replacement without waiting for settlement of the claim with the carrier.

2-13. REPACKING FOR SHIPMENT.

2-14. If Model 1825A is to be shipped to an HP Sales/Service Office for service or repair, attach a tag showing owner (with address), complete instrument serial number, and a description of the service required.

2-15. Use the original shipping carton and packing material. If the original packing material is not available, the HP Sales/Service Office will provide information and recommendations on materials to be used. Materials used for shipping an instrument normally include the following:

a. A double-walled carton; refer to table 2-1 for test strength required.

b. Heavy paper or sheets of cardboard to protect all instrument surfaces; use a nonabrasive material such as polyurethane or cushioned paper such as Kimpak around all projecting parts.

c. At least 4 inches of tightly-packed, industry approved, shock-absorbing material such as extra-firm polyurethane foam.

d. Heavy-duty shipping tape for securing outside of carton.

Table 2-1. Shipping Carton Test Strength

Gross Weight (lb)	Carton Test Strength (lb)
up to 10	200
10 to 30	275
30 to 120	350
120 to 140	500
140 to 160	600

1. DISPLAY. Selects sweep display mode: MAIN, MIXED, or DELAYED.

2. DELAYED TIME/DIV. Selects sweep speed of delayed time base in 18 ranges. Has an OFF position.

3. DELAYED TRIG LEVEL. Selects point on delayed trigger signal that starts sweep. Also selects DELY'D STARTS AFTER DELAY.

4. INTENS RATIO. Adjusts intensity difference between main and delayed sweep when DISPLAY is set to MAIN and DELAYED TIME/DIV is not OFF.

5. DELAY. Selects time delay between start of main sweep and start of delayed sweep.

6. DELAYED POS/NEG. Determines whether positive or negative slope of trigger signal starts delayed sweep.

7. DELAYED LF REJECT. Attenuates delayed trigger signals below 15 kHz.

8. DELAYED HF REJECT. Attenuates delayed trigger signals above 15 kHz.

9. DELAYED ÷1/÷10. Selects attenuated or unattenuated delayed trigger signal.

10. DELAYED INT/EXT. Selects trigger signal from vertical plug-in or from DELAYED EXT INPUT.

11. DELAYED EXT INPUT. BNC connector for applying delayed trigger signal.

12. DELAYED AC/DC. Selects direct or capacitive coupling for delayed trigger signal.

13. LINE. Selects line triggering for main sweep.

14. MAIN AC/DC. Selects direct or capacitive coupling for main trigger signal.

15. MAIN EXT INPUT. BNC connector for applying main trigger signal.

16. MAIN LF REJECT. Attenuates main trigger signals above 15 kHz.

17. MAIN HF REJECT. Attenuates main trigger signals below 15 kHz.

18. MAIN ÷1/÷10. Selects attenuated or unattenuated main trigger signals.

19. MAIN INT/EXT. Selects trigger signal from vertical plug-in or from MAIN EXT INPUT.

20. MAIN POS/NEG. Determines whether positive or negative slope of trigger signal starts main sweep.

21. AUTO/NORM. Selects automatic sweep start or triggered sweep start for main sweep.

22. SINGLE. Selects single sweep operation for main sweep.

23. RESET. Rearms sweep after single sweep operation.

24. HOLDOFF. Adjusts time between end of one main sweep and arming of next.

25. VERNIER. Permits selection of sweep speeds between calibrated ranges of MAIN TIME/DIV switch.

26. RESET lamp. Indicator lights when main sweep is armed.

27. UNCAL. Indicator lights when main sweep is rotated out of calibrated position.

28. MAIN TRIG LEVEL. Selects point of trigger signal that starts main sweep.

29. MAIN TIME/DIV. Selects sweep speed of main sweep in 23 ranges.

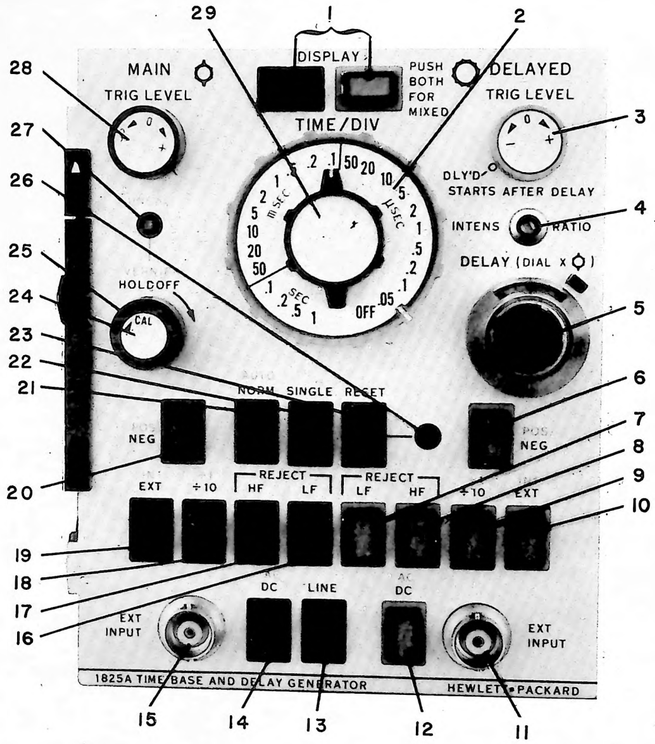
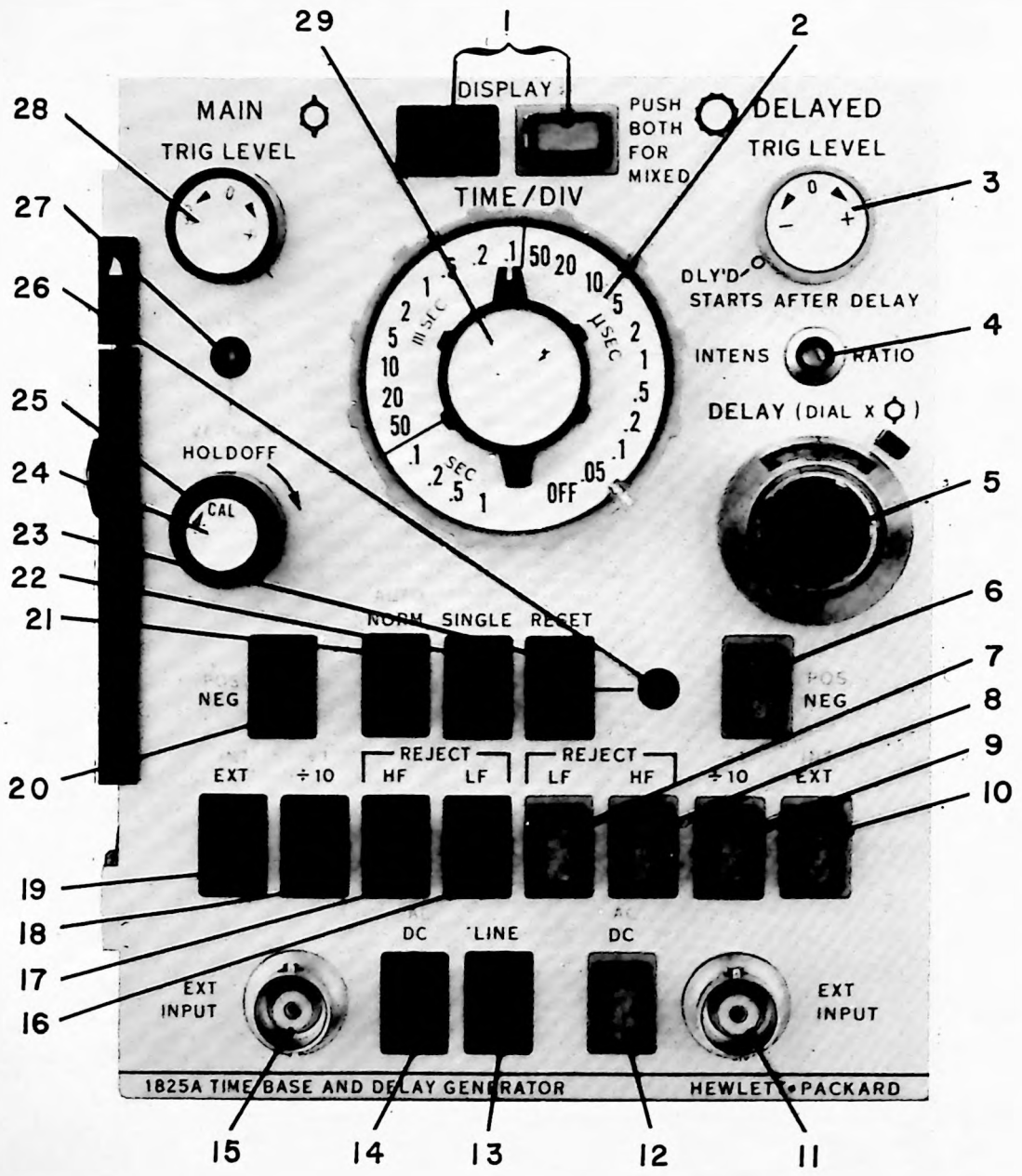


Figure 3-1.
Front Panel Controls and Connectors


DISPLAY
MAIN
TRIG LEVEL
PUSH BOTH FOR MIXED
DELAYED
TRIG LEVEL
TIME/DIV
DLY'D
STARTS AFTER DELAY
INTENS
RATIO
DELAY (DIAL X)
HOLDOFF
CAL
NORM
SINGLE
RESET
POS
NEG
EXT
÷10
REJECT
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1825A TIME BASE AND DELAY GENERATOR
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SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. This section contains an explanation of the instrument operating controls, available modes of operation, triggering considerations (frequencies, amplitudes, modes), and step-by-step instructions for most applications.

3-3. Necessary oscilloscope and vertical plug-in control settings are mentioned but, due to the variety of different mainframe and plug-in combinations that can be used with Model 1825A, the operating and service manual for the specific instrument should be referred to for supplementary information.

3-4. CONTROLS AND CONNECTORS.

3-5. Figure 3-1 shows the instrument front panel and provides functional descriptions of operating controls, indicators, and connectors. The following paragraphs provide detailed descriptions of controls with multiple or complex functions. Because some of the delayed controls are identical in function to main controls, only main controls and those not common to both are explained.

3-6. TRIGGER CONDITIONING.

3-7. Model 1825A is equipped with pushbutton switches for controlling sweep triggering. Trigger signal requirements are listed in table 3-1. The controls are described in the following paragraphs.

3-8. SWITCH DESCRIPTION. The switches are push-push type which alternate between two positions each time the switch is pressed. The one exception is the RESET switch which does not lock into the depressed position. Each switch is equipped with a blue band which disappears when the switch is in the depressed position. The band is related to the color of the switch designator. If the blue band is showing, the action whose designator is printed in blue is activated. If the blue band is hidden, the action whose designator is printed in black is activated. The face of each switch is either black or gray. The black switches are main sweep controls. The gray switches are delayed sweep controls.

3-9. TRIGGER SOURCE. When the MAIN INT/EXT switch is in INT, the sweep is synchronized to the vertical deflection signal. In EXT, the sweep will be synchronized to a signal connected to the MAIN EXT INPUT connector. In the depressed position, the MAIN ÷1/÷10 switch causes the incoming sync signal to be attenuated by a factor of 10. In the depressed position, the LINE switch synchronizes the sweep to a fixed amplitude power line signal regardless of the positions of the MAIN INT/EXT and MAIN ÷1/÷10 switches.

3-10. TRIGGER COUPLING. The MAIN AC/DC switch selects direct coupling (DC) or capacitive coupling (AC). Direct coupling can be used from dc to greater than 150 MHz. Capacitive coupling blocks the dc component of a trigger signal and passes only the ac component. Capacitive coupling, however, attenuates signals below approximately 20 Hz. The MAIN LF REJECT switch, when depressed, attenuates signals below approximately 15 kHz and is used, for instance, to prevent power line frequency ripples from triggering the sweep. The MAIN HF REJECT switch, when depressed, attenuates signals above approximately 15 kHz and can be used, for instance, to prevent high frequency noise from triggering the sweep.

3-11. MAIN TRIG LEVEL.

3-12. This control selects the point on the trigger signal that starts the sweep. The triggering point is adjustable over a range from −2V to +2V along the selected sync signal slope in the INT, EXT, and LINE positions. In the ÷10 position the trigger level is adjustable from −20V to +20V. DELAYED TRIG LEVEL is inoperative when DELAYED TRIG LEVEL is switched to DLY'D STARTS AFTER DELAY.

Table 3-1. Trigger Signal Requirements

	SWEEP MODE	TRIGGER SOURCE	TRIGGER COUPLING	MINIMUM TRIGGER AMPLITUDE	LEVEL		SLOPE
MAIN	NORM	LINE		FIXED			SELECTABLE + or −
		INT EXT	DC: dc to 150 MHz. AC: 20 Hz to 150 MHz. REJECT LF: 15 kHz to 150 MHz. REJECT HF: dc to 30 kHz.	20 Hz −100 MHz ⩾ 1/2 div of vertical deflection See figure 3-2.	In ÷1 Adjustable +2V to −2V	In ÷10 Adjustable +20V to −20V	
	AUTO	LINE		FIXED			
		INT EXT	DC: 40 Hz to 150 MHz. AC: 40 Hz to 150 MHz. REJECT LF: 15 kHz to 150 MHz. REJECT HF: 40 Hz to 30 kHz.	40 Hz −100 MHz ⩾ 1/2 div of vertical deflection See figure 3-2.	In ÷1 Adjustable +2V to −2V	In ÷10 Adjustable +20V to −20V	
	SINGLE	Single may be selected after setting up any display					
DELAYED	NORM			See Vert. MANUAL			
		INT EXT	DC: dc to 150 MHz. AC: 20 Hz to 150 MHz. REJECT LF: 15 kHz to 150 MHz. REJECT HF: dc to 30 kHz.	See figure 3-2.	In ÷1 +2V to −2V	In ÷10 +20V to −20V	
	DLY'D STARTS AFTER DELAY	No Function		Automatically triggered at end of delay	No Function		

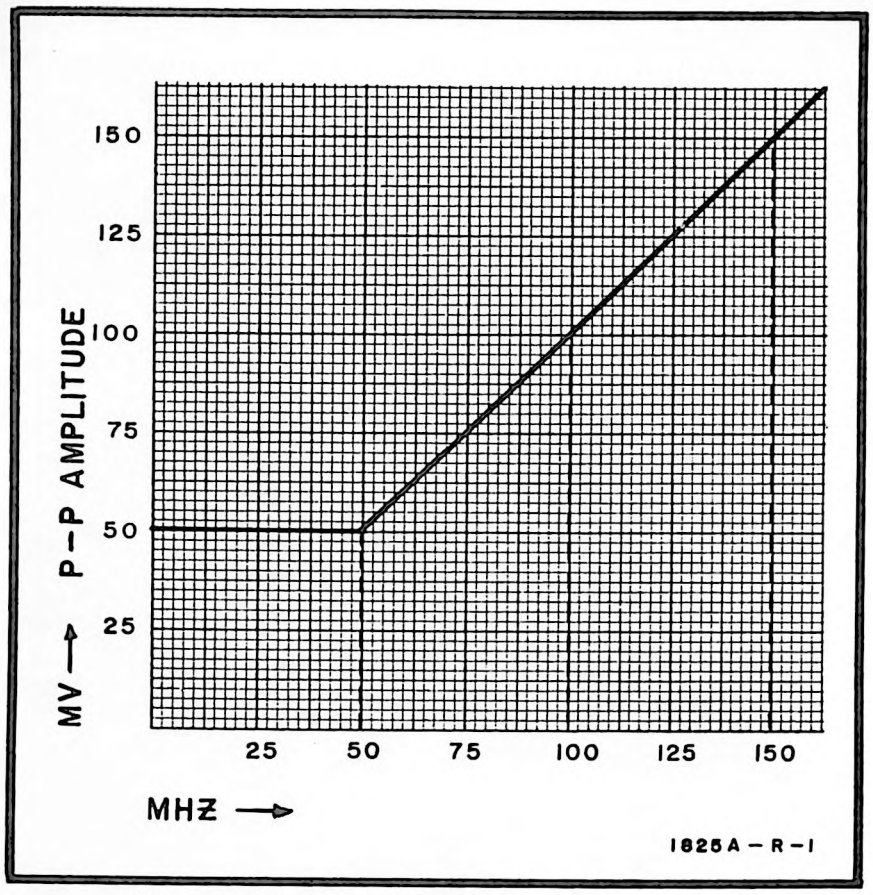


Figure 3-2. External Trigger Requirements

3-13. HOLDOFF.

3-14. Holdoff time is the time interval following the end of one sweep during which the time base will not trigger. The sweep is started by the first trigger pulse after holdoff time elapses. This time can be varied by rotating the HOLDOFF control. This feature makes it possible to avoid (in normal operation) triggering of successive sweeps at two or more points on a complex waveform (see figure 3-3).

3-15. SWEEP MODE.

3-16. In AUTO, the sweep free-runs in the absence of a trigger signal, displaying a bright baseline. If a trigger signal of 40 Hz or greater is applied, it overrides free-run operation and triggers the sweep.

3-17. In NORM, a trigger input signal is needed to initiate a display. Use NORM if the trigger signal exceeds 25 milliseconds or the frequency is less than 40 Hz.

3-18. In SINGLE sweep mode, only one sweep is generated after being triggered. To rearm the sweep, the RESET button must be pushed and released. The RESET lamp lights to indicate that the sweep is armed. In AUTO, one sweep will occur each time RESET is pressed. In NORM, one sweep will occur the first time a trigger is applied after pressing RESET.

3-19. SLOPE.

3-20. The MAIN POS/NEG switch determines whether the sweep triggers on the positive-going or negative-going portion of the sync signal.

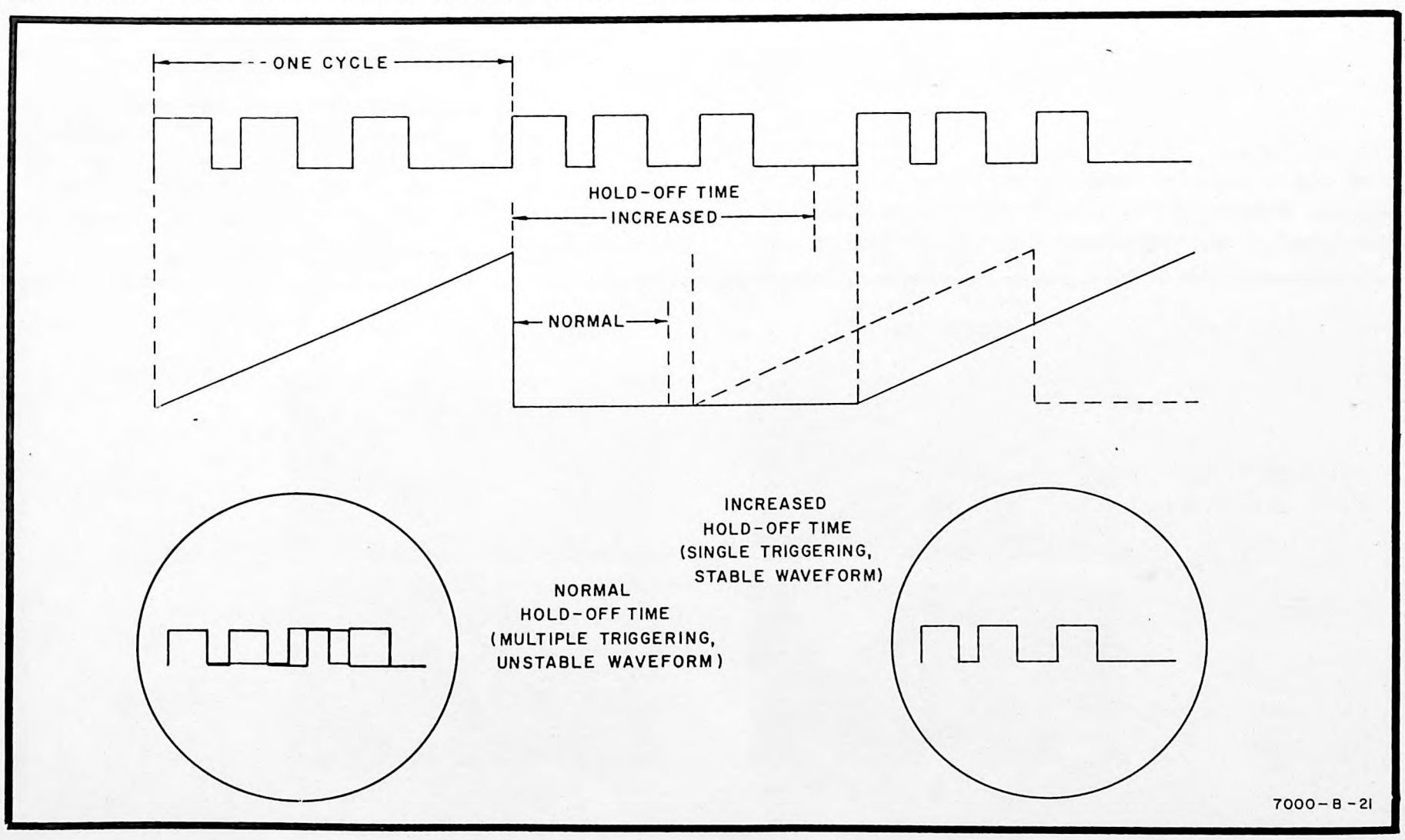


Figure 3-3. Trigger Holdoff

3-21. DISPLAY.

3-22. The display is controlled by two pushbutton switches. Pressing the black DISPLAY switch activates main sweep. Pressing the gray DISPLAY switch activates delayed sweep. Pressing both activates mixed sweep. The function of each mode is explained in paragraphs 3-23, 3-24 and 3-25.

3-23. MAIN. In this mode the main sweep sets a time base reference for the vertical signal, and delayed sweep is not displayed (figure 3-4A). Main sweep controls are mounted on the left side of the front panel, and sweep speed is selected by MAIN TIME/DIV. If DELAYED TIME/DIV is set to OFF, sweep intensity is uniform. However, any other setting of DELAYED TIME/DIV causes the sweep to intensify during the time that delayed sweep is generated, as illustrated in figure 3-4B (if the delayed sweep is properly triggered). This feature makes it possible to select a point of interest on the main sweep time base before viewing in the MIXED or DELAYED modes.

3-24. MIXED. Main and delayed sweeps combine in this mode for a dual-sweep display (figure 3-4C). Sweep speed of the first display portion is controlled by MAIN TIME/DIV, and DELAYED TIME/DIV controls sweep speed of the last display portion.

3-25. DELAYED. Main sweep is not displayed in this mode. Only the intensified portion of the sweep displayed in MAIN is used as a time base, as illustrated in figure 3-4D. This is the delayed sweep and its speed is controlled by DELAYED TIME/DIV.

3-26. TIME/DIV.

3-27. MAIN and DELAYED TIME/DIV switches determine the amount of time to sweep horizontally one graticule division. Both controls are concentric and are interlocked so that the delayed sweep is never slower than the main. Main sweep speeds are selectable by MAIN TIME/DIV in twenty-three ranges from 0.05 usec/div to 1 sec/div. Eighteen ranges of delayed sweep speeds from 0.05 usec/div to 50 ms/div are provided by DELAYED TIME/DIV. Also, by switching the Oscilloscope Magnifier control to X5 or X10, a display can be magnified up to ten times. To view a main sweep of uniform intensity in the MAIN sweep display mode, turn DELAYED TIME/DIV to OFF.

3-28. VERNIER.

3-29. Sweep speed is calibrated to MAIN TIME/DIV when the VERNIER control is set fully clockwise to the CAL detent position. As the VERNIER control is turned counterclockwise, the UNCAL indicator lights and sweep speed decreases to at least 2.5 times the MAIN TIME/DIV setting. The VERNIER control is useful for making discrete adjustments of sweep speed; however, MAIN TIME/DIV readings are uncalibrated.

3-30. DELAY.

3-31. This adjustment controls delay time between main sweep start and delayed sweep arming. The DELAY dial can be used for time interval measurements with DELAYED TRIG LEVEL in DELY'D STARTS AFTER DELAY. Desired trigger events can be selected in triggered mode (DELAYED TRIG LEVEL out of detent). Multiply the MAIN TIME/DIV setting by the difference between DELAY settings of two events to measure time difference. Delay time is continuously variable from 0.1 usec to 10 sec.

3-32. OPERATING PROCEDURES.

3-33. Figures 3-5 through 3-8 give step-by-step instructions for operating Model 1825A. These instructions are for typical applications and can be modified to adapt the instrument to a variety of unique applications. Refer to the oscilloscope and vertical plug-in operating and service manuals for related operating information.

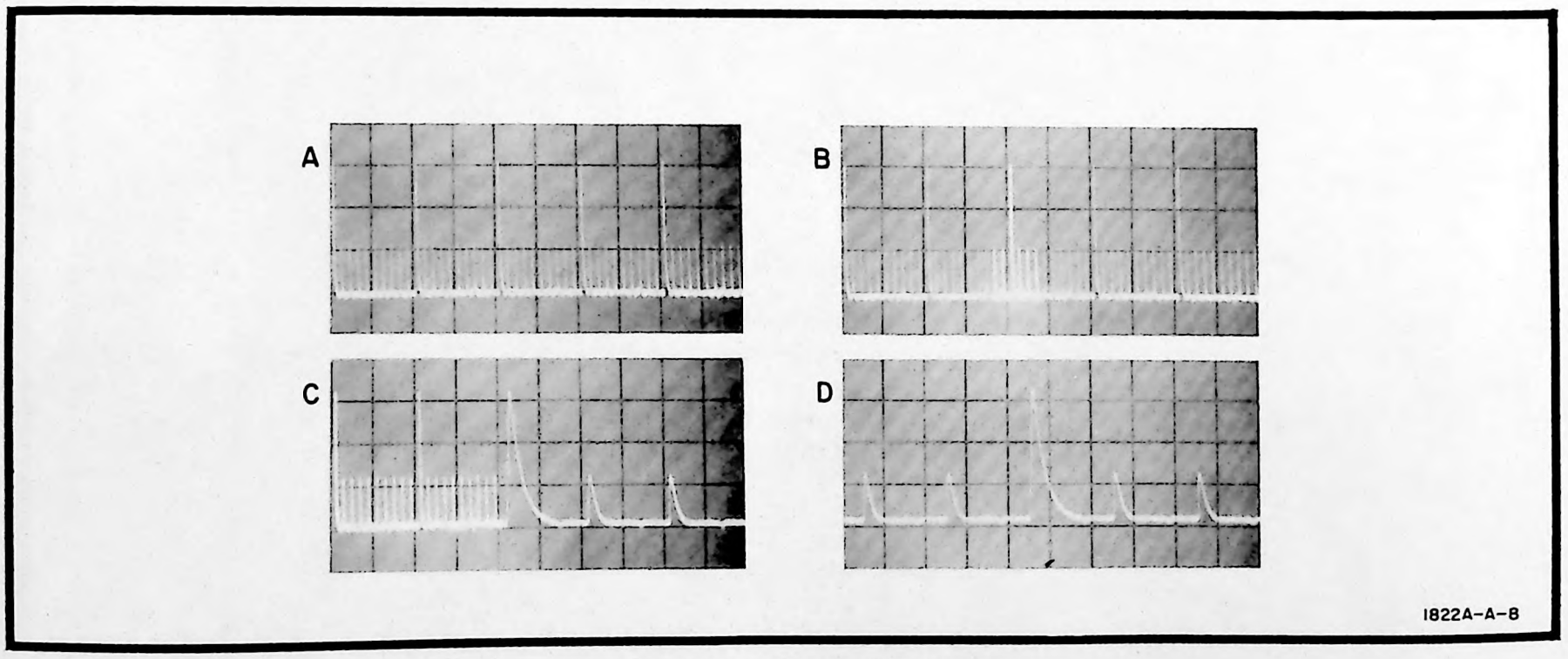
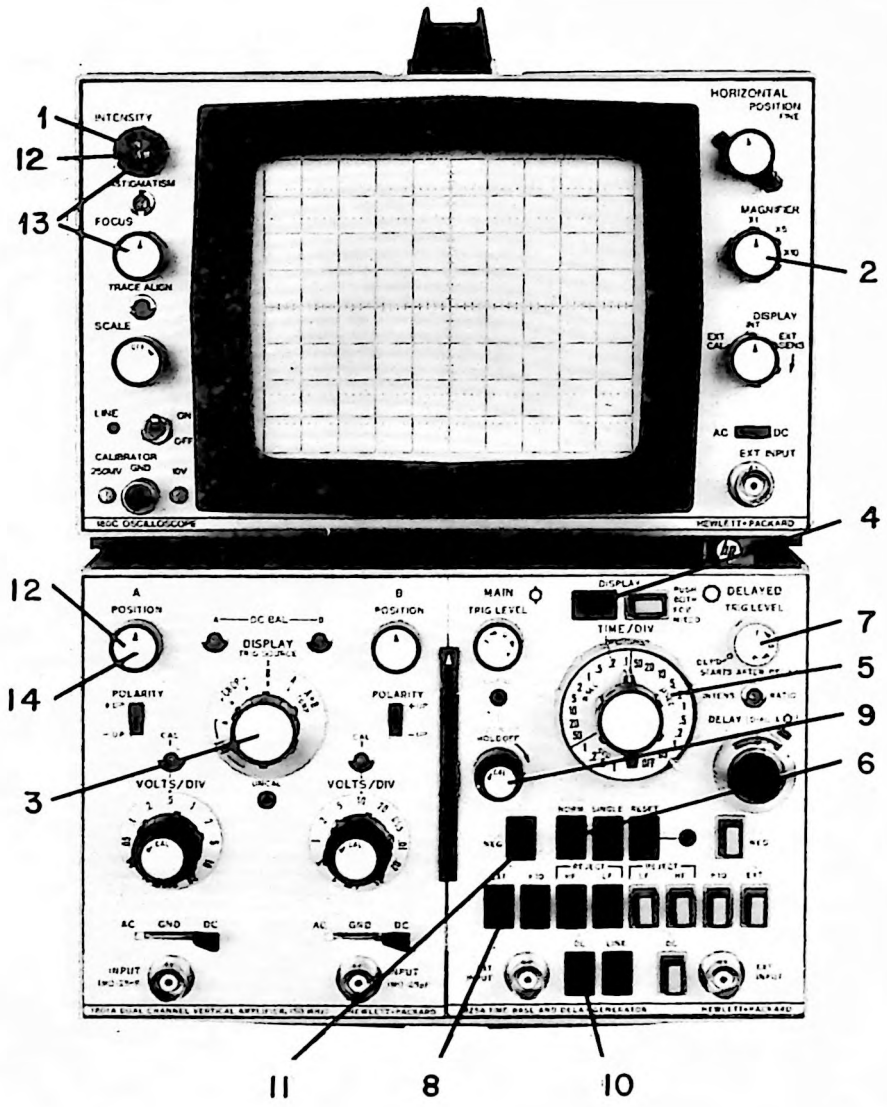


Figure 3-4. Sweep Displays



1. Set INTENSITY fully counterclockwise.
2. Set MAGNIFIER to X1.
3. Set DISPLAY to INT.
4. Set DISPLAY to MAIN (paragraph 3-22).
5. Set MAIN/TIME DIV to 1 MSEC.
6. Set AUTO/NORM to AUTO.
7. Set DELAYED TRIG LEVEL to DELY'D STARTS AFTER DELAY.
8. Set MAIN INT/EXT to INT.
9. Set HOLDOFF fully counterclockwise.
10. Set MAIN AC/DC to DC.
11. Set MAIN POS/NEG to POS.
12. Energize and use FIND BEAM with INTENSITY and POSITION controls to locate trace (if necessary).
13. Alternately adjust INTENSITY and FOCUS for a clear and just visible trace.
14. Adjust POSITION controls to center trace.

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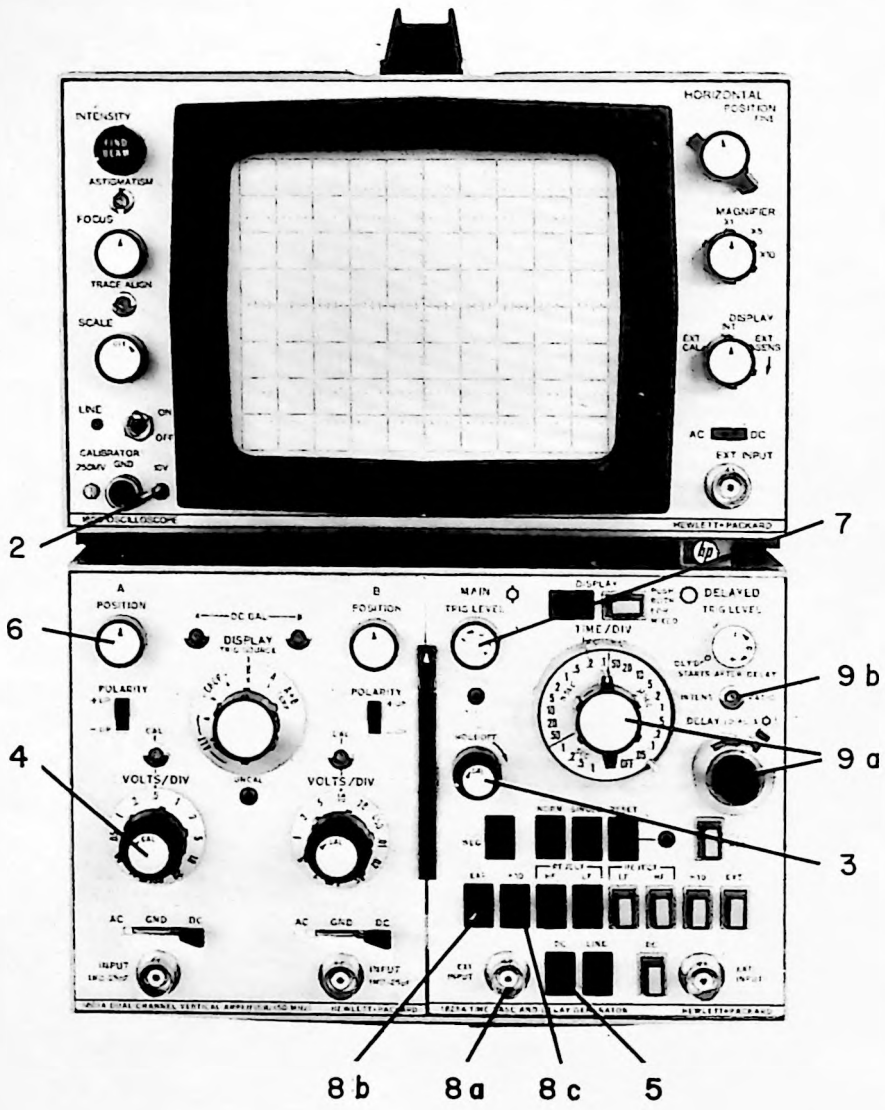
Figure 3-5. Initial Turn-on Procedure

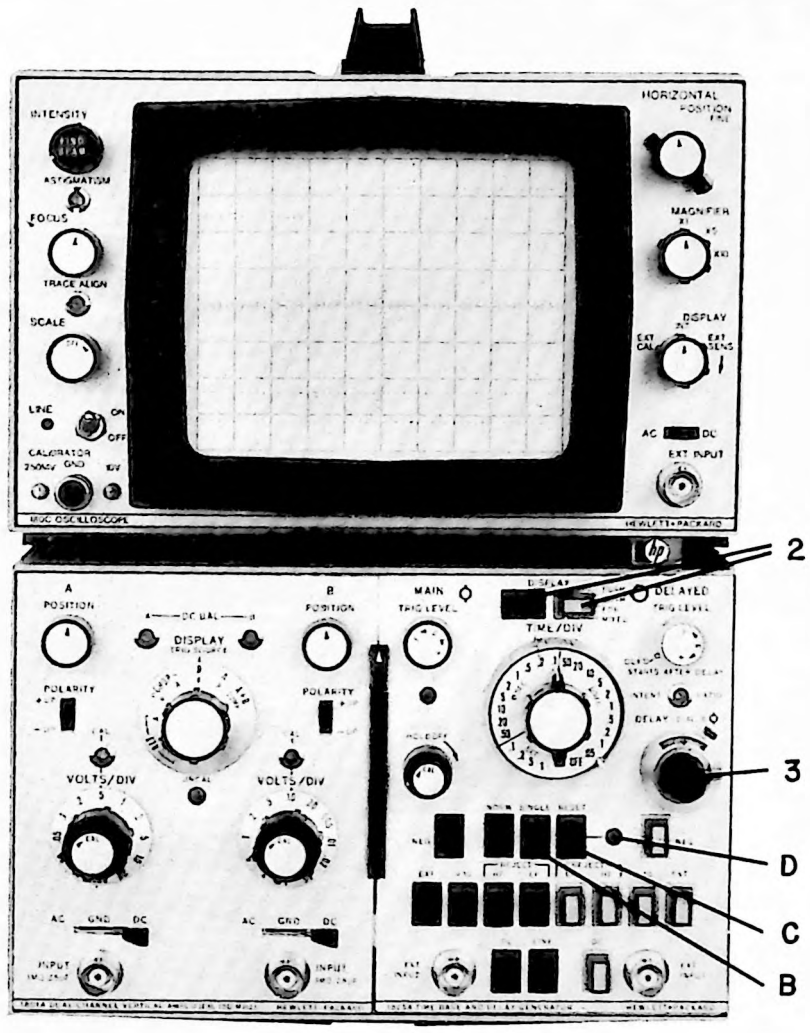


As an example, the following procedure explains how to display a 10V, 1-kHz signal using the main time base.

1. Perform initial turn-on procedure as explained in figure 3-5.
2. Connect 10V CALIBRATOR signal to vertical INPUT.
3. Set VERNIER fully counterclockwise.
4. Set VOLTS/DIV for 5 divisions of vertical display.
5. Set AC/DC to DC.
6. Adjust position control for mid-screen display.
7. Adjust MAIN TRIG LEVEL for stable display.
8. To trigger externally:
   a. Apply input signal to MAIN EXT INPUT.
   b. Set MAIN INT/EXT to EXT.
   c. Set ÷1/÷10 to ÷10.
9. To intensify display during time that delayed sweep is generated:
   a. Adjust DELAYED TIME/DIV and DELAY as required to intensify point of interest.
   b. Adjust INTENS RATIO for desired intensity difference.

1825A-R-5

Figure 3-6. Main Sweep Operation



MIXED SWEEP OPERATION

1. Perform main sweep procedure as explained in figure 3-6.
2. Set DISPLAY to MIXED (both pushed).
3. Adjust DELAY until desired waveform is displayed on CRT.

SINGLE SWEEP OPERATION

A. Single sweep can be used after setting up any type of display.

B. Push SINGLE.

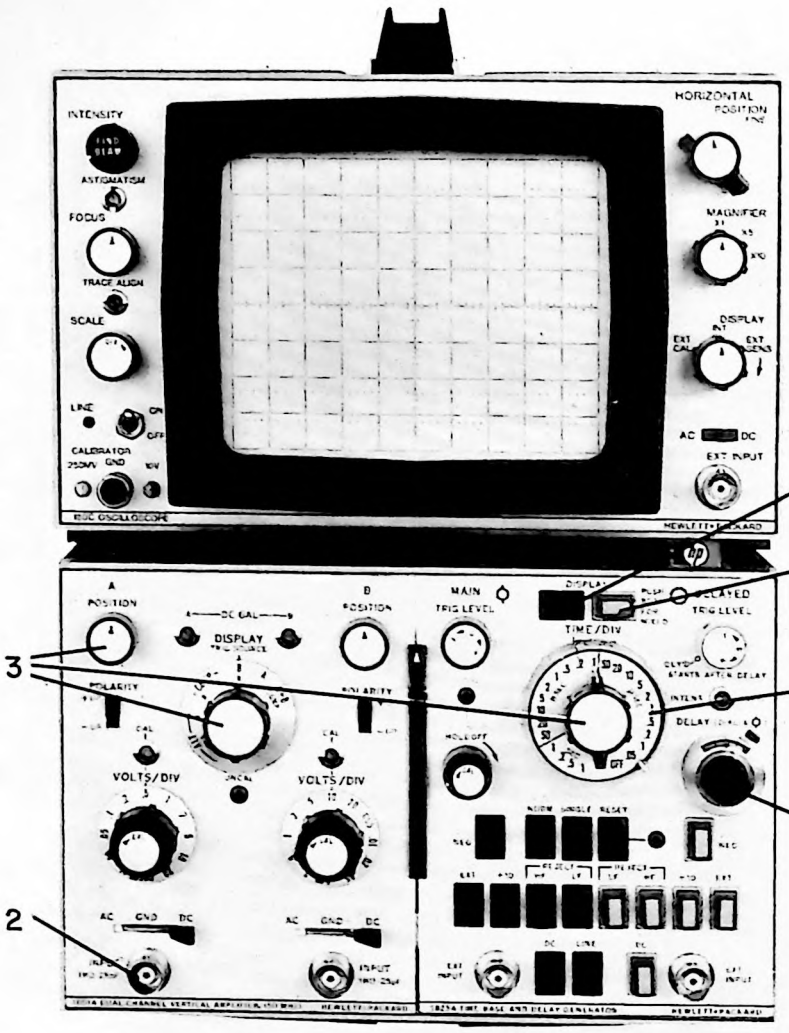
C. Push RESET and release.

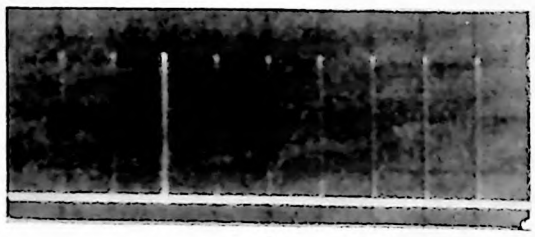
D. RESET indicator lights to indicate sweep is armed. Sweep is started by next trigger signal.

E. After display, light goes out until sweep is manually reset (Step C).

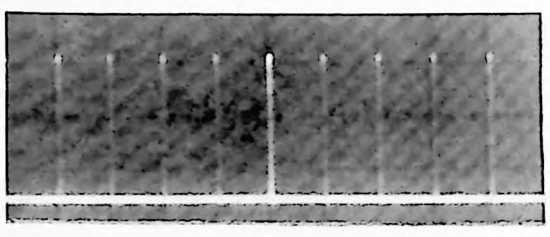
1825A-R-6

Figure 3-7. Mixed and Single Sweep Operation



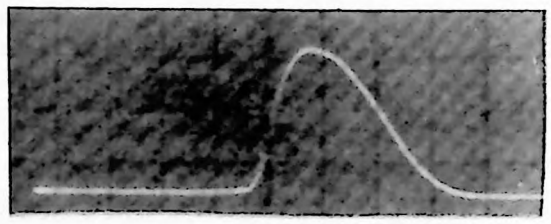


A



B

C



D

1. Perform initial turn-on procedure as explained in figure 3-5.
2. Apply signal to vertical INPUT.
3. Adjust vertical controls and MAIN TIME/DIV for desired display.
4. Set DELAY to 0.5.
5. Set DELAYED TIME/DIV to intensify desired portion of display.
6. Adjust DELAY to intensify first point of interest (figure A).
7. Set DISPLAY to DELAYED.
8. Adjust DELAY to set point of interest on Y-axis (figure B).
9. Record DELAY setting.
10. Set DISPLAY to MAIN.
11. Adjust DELAY to intensify second point of interest (figure C).
12. Set DISPLAY to DELAYED.
13. Adjust DELAY to set point of interest on same reference line as in step 8 (figure D).
14. Record DELAY setting.
15. To determine time difference between first and second points of interest, multiply MAIN TIME/DIV setting by difference between DELAY settings recorded in steps 9 and 14.

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Figure 3-8. Time Difference Measurements

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section contains functional descriptions keyed to an overall block diagram. A detailed explanation of circuit functions, keyed to the schematics, is provided after the block diagram discussion. Following this, complete cycles of operation (for various modes) will be discussed.

4-3. The block diagram and the schematics are located at the rear of Section VIII.

4-4. BLOCK DIAGRAM.

4-5. The block diagram is provided as an aid to understanding the operation of the instrument. Circuit groups have been consolidated into single blocks and logic symbols according to function. This makes it easier to define each group's inputs and outputs and to show relationships between groups.

4-6. MAIN TRIGGER CONDITIONER.

4-7. The main trigger conditioner group contains the switching circuitry required to select and shape the main trigger.

4-8. A detailed explanation of the main trigger conditioner is provided in paragraph 4-78.

4-9. MAIN IMPEDANCE CONVERTERS.

4-10. Two impedance converters are employed to provide a means of removing an interfering component from the main trigger signal. The main HF impedance converter attenuates frequencies below approximately 15 kilohertz. The main LF impedance converter attenuates frequencies above approximately 15 kilohertz. An interfering signal component can be removed by disabling one of the impedance converters.

4-11. A detailed explanation of the main impedance converters is provided in paragraph 4-86.

4-12. MAIN TRIGGER AMPLIFIER AND POLARITY SWITCH.

4-13. The main trigger amplifier and polarity switch group provides a means of amplifying and switching the polarity of the main trigger signals. Switching is required in order to permit sweep triggering on either the positive or negative slope of the displayed signal, as desired.

4-14. A detailed explanation of the main trigger amplifier and polarity switch is provided in paragraph 4-89.

4-15. MAIN DUAL SCHMITT.

4-16. The main dual Schmitt prohibits triggering during a main sweep cycle and permits triggering of a new sweep after the termination of the main sweep cycle.

4-17. A detailed explanation of the main dual Schmitt is provided in paragraph 4-94.

4-18. MAIN INTEGRATOR GATE.

4-19. The main integrator gate is a dual input Schmitt trigger that provides a gating pulse to the main integrator. It also provides gating pulses to a rear panel connector on the oscilloscope mainframe. In NORM, the main integrator gate prohibits the sweep from free-running in the absence of a trigger signal. In AUTO, sweep free-running is permitted, providing a baseline display on the oscilloscope CRT in the absence of a trigger signal.

4-20. A detailed explanation of the main integrator gate is provided in paragraph 4-98.

4-21. MAIN 10V SCHMITT.

4-22. The main 10V Schmitt controls the main dual Schmitt and the auto and lockout groups, assuring a trigger to start the main sweep at the proper time and prohibiting further triggering during the sweep cycle.

4-23. A detailed explanation of the main 10V Schmitt is provided in paragraph 4-102.

4-24. MAIN INTEGRATOR.

4-25. The main integrator contains a Miller integrator and the gating circuitry required to clamp and unclamp the integrator, as required. When unclamped, the integrator generates a linear ramp that is used as the main time base for the oscilloscope. The main ramp is also provided to a rear panel connector on the oscilloscope mainframe.

4-26. A detailed explanation of the main integrator is provided in paragraph 4-105.

4-27. HOLDOFF DRIVER AND READER.

4-28. The holdoff driver and reader function as impedance matching devices. The driver matches the output of

the integrator to the holdoff charging circuit. The reader matches the holdoff charging circuit to the input of the main 10V Schmitt.

4-29. A detailed explanation of the holdoff driver and reader is provided in paragraph 4-112.

4-30. AUTO AND LOCKOUT.

4-31. The auto and lockout group permits the output of the main 10V Schmitt to trigger the main sweep in the absence of a trigger from one of the trigger inputs, in order to cause free-running of the main sweep.

4-32. A detailed explanation of the auto and lockout group is provided in paragraph 4-114.

4-33. MAIN SWEEP SWITCH AND VERNIER.

4-34. The main sweep switch selects the required integrating capacitors and resistors for each range (TIME/DIV). The vernier provides a variable charging voltage to the integrator to permit selection of sweep frequencies between the calibrated ranges.

4-35. A detailed explanation of the main sweep switch and vernier is provided in paragraph 4-118.

4-36. DELAYED TRIGGER CONDITIONER.

4-37. The delayed trigger conditioner group contains the switching circuitry required to select and shape the delayed trigger.

4-38. A detailed explanation of the delayed trigger conditioner is provided in paragraph 4-120.

4-39. DELAYED IMPEDANCE CONVERTERS.

4-40. Two impedance converters are employed as a means of removing an interfering component from the delayed trigger signal. The delayed HF impedance converter attenuates frequencies below approximately 15 kilohertz. The delayed LF impedance converter attenuates frequencies above approximately 15 kilohertz. An interfering component can be removed by disabling one of the impedance converters.

4-41. A detailed explanation of the delayed impedance converters is provided in paragraph 4-127.

4-42. DELAYED TRIGGER AMPLIFIER AND POLARITY SWITCH.

4-43. The delayed trigger amplifier and polarity switch group provides a means of amplifying and switching the polarity of the delayed trigger signals. Switching is required in order to permit sweep triggering on either the positive or negative slope of the displayed signal, as desired.

4-44. A detailed explanation of the delayed trigger amplifier and polarity switch is provided in paragraph 4-130.

4-45. DELAYED DUAL SCHMITT.

4-46. The delayed dual Schmitt prohibits triggering during a delayed sweep cycle and permits triggering of a new sweep after the termination of the delayed sweep cycle.

4-47. A detailed explanation of the delayed dual Schmitt is provided in paragraph 4-135.

4-48. DELAYED INTEGRATOR GATE.

4-49. The delayed integrator gate is a Schmitt trigger that provides a gating pulse to the delayed integrator. It also provides gating pulses to a rear panel connector on the oscilloscope mainframe.

4-50. A detailed explanation of the delayed integrator gate is provided in paragraph 4-139.

4-51. DELAYED 10V SCHMITT AND DELAYED CONTROL SCHMITT.

4-52. Together, the delayed 10V Schmitt and the delayed control Schmitt operate the delayed dual Schmitt, assuring a trigger to start the delayed sweep at the proper time and prohibiting further triggering during the delayed sweep cycle.

4-53. A detailed explanation of the delayed 10V Schmitt and delayed control Schmitt is provided in paragraph 4-141.

4-54. DELAYED INTEGRATOR.

4-55. The delayed integrator contains a Miller integrator and the gating circuitry required to clamp and unclamp the integrator, as required. When unclamped, the integrator generates a linear ramp that is used as the delayed time base for the oscilloscope. The delayed ramp is also provided to a rear panel connector on the oscilloscope mainframe.

4-56. A detailed explanation of the delayed integrator is provided in paragraph 4-144.

4-57. DELAYED STARTS AFTER DELAY.

4-58. When the DELAYED TRIG LEVEL control is set to DELY'D STARTS AFTER DELAY, the delayed starts after delay group permits the delayed control Schmitt to trigger the delayed dual Schmitt. This provides a trigger for the delayed integrator in the absence of a delayed trigger signal.

4-59. A detailed explanation of the delayed starts after delay group is provided in paragraph 4-151.

4-60. DELAYED SWEEP SWITCH.

4-61. The delayed sweep switch selects the required integrating capacitors and resistors for each range (TIME/DIV). The delayed sweep switch group also provides a fixed charging voltage for the delayed integrator.

4-62. A detailed explanation of the delayed sweep switch is provided in paragraph 4-153.

4-63. INTERNAL TRIGGER PICKOFF.

4-64. The internal trigger pickoff group applies trigger signals from the vertical plug-in to the main trigger conditioner. Isolation between the two trigger conditioners is also provided.

4-65. A detailed explanation of the internal trigger pickoff group is provided in paragraph 4-157.

4-66. COMPARATOR.

4-67. In the comparator, the main ramp is compared with a voltage selected by the calibrated DELAY control. This makes possible the precise selection of either the arming point (triggered mode) or the starting point (delayed starts after delay mode) of the delayed ramp.

4-68. A detailed explanation of the comparator is provided in paragraph 4-162.

4-69. DISPLAY SWITCH.

4-70. The display switch group, consisting of the MAIN and DELAYED DISPLAY switches, connects the main ramp, the delayed ramp, or both to the oscilloscope mainframe. The display switch group also provides control voltage to the gate Schmitt and intensify group.

4-71. A detailed explanation of the display switch group is provided in paragraph 4-165.

4-72. GATE SCHMITT AND INTENSIFY.

4-73. The gate Schmitt and intensify group accepts the main integrator gate, the delayed integrator gate and a dc voltage selected by the INTENS RATIO control and combines them into a composite gate to control the intensity of the oscilloscope CRT.

4-74. A detailed explanation of the gate Schmitt and intensity group is provided in paragraph 4-172.

4-75. SCHEMATIC EXPLANATION.

4-76. The circuits of Model 1825A are diagrammed in 10 schematics located at the rear of this manual. Each explanation will be keyed to one or more of these schematics.

4-77. These explanations are not intended as instruction in basic electronics. For instance, when discussing a Schmitt trigger, it will be assumed that the reader knows how a Schmitt trigger operates. The explanation will proceed only to the depth necessary to tie the circuit to the overall operation of the instrument. Unusual circuits will be explained in greater detail.

4-78. MAIN TRIGGER CONDITIONER.

4-79. The main trigger conditioner circuits (schematic 1) consist of A1S1A, A1S1B, A1S2A, A1S2B, A1S4A, A1S4B, and associated components. Line, external, and internal triggers are brought in on lines (1), (2), and (3) respectively. The outputs are on lines (4) and (5).

4-80. The MAIN INT/EXT switch selects a trigger either from the oscilloscope vertical plug-in or the output of some external device connected to the MAIN EXT INPUT connector on the front panel of Model 1825A.

4-81. The MAIN ÷1/÷10 switch connects the selected input directly or through a 10:1 divider.

4-82. The MAIN HF REJECT switch, when operated, applies a bias to the gate of A1Q1 to disable the HF impedance converter.

4-83. The MAIN AC/DC switch connects the selected input directly or capacitively to the LF impedance converter. The HF impedance converter is always capacitively coupled through A1C2.

4-84. The MAIN LF REJECT switch, when operated, disconnects and grounds the input to the LF impedance converter.

4-85. The LINE switch, when operated, connects a 60-hertz signal from the oscilloscope mainframe via line (1) to the LF impedance converter. It also applies a disabling bias to the HF impedance converter.

4-86. MAIN IMPEDANCE CONVERTERS.

4-87. The main HF impedance converter (schematic 1) is a high impedance input, low impedance output, noninverting amplifier consisting of FET amplifier A1Q1 and grounded collector amplifier A1Q2. Its input is on line (5) and its output is on line (8). The amplifier can be disabled by applying −12.6 volts to the gate of A1Q1 via A1S3B, A1S3A, and A1R6 or via A1S4B.

4-88. The main LF impedance converter is a high impedance input, low impedance output, inverting amplifier consisting of operational amplifier A2U1 and emitter follower A2Q1. Its input is on line (4) and its output is on line (7). The amplifier can be disabled by grounding its input via A1S3B and A1S4B.

4-89. MAIN TRIGGER AMPLIFIER AND POLARITY SWITCH.

4-90. The main trigger amplifier (schematic 1) is a two-section differential amplifier with the polarity switch between the two sections.

4-91. The input amplifier section consists of differential amplifier of A1U1Q1 and A1U1Q2, with current source A1U1Q3. Inputs are from the main impedance converters via lines (7) and (8). Outputs are to the polarity switch via lines (11) and (12).

4-92. The polarity switch consists of two common-base amplifiers with common inputs and cross coupled outputs. One amplifier (A1Q4 and A1Q5) is turned on when the POS/NEG switch is set to POS. The other amplifier (A1Q3 and A1Q6) is turned on when the POS/NEG switch is set to NEG. Assume that a positive-going pulse is present on line (13) and a negative-going pulse is present on line (14). Because the outputs of the two amplifiers are cross coupled, changing the position of the MAIN POS/NEG switch will enable the other amplifier and the pulse on line (13) will be negative going while the pulse on line (14) will be positive going. The pulse polarity on lines (13) and (14) to the second amplifier section will be switched (reversed).

4-93. The output amplifier section consists of differential amplifier A1U1Q4 and A1U1Q5 with current source A1U1Q6. The setting of the adjustable resistor (A1R25) at the output of the amplifier is critical to the operation of the main dual Schmitt, which it feeds.

4-94. MAIN DUAL SCHMITT.

4-95. The main dual Schmitt (schematic 2) consists of A1U1A and A1U1B, two OR circuits with biasing and feedback to cause them to function as Schmitt triggers. The main dual Schmitt is controlled by pulses on lines (15) and (16) from the main trigger amplifier and on line (18) from the main 10V Schmitt.

4-96. In the quiescent state, the voltage on line (18) from the 10V Schmitt is low and, assuming the MAIN POS/NEG switch is set to POS, line (15) is high and line (16) is low. As long as one of the three lines ((15), (16), or (18)) is high, line (21) (main dual Schmitt output) will be high.

4-97. The output of A1U2A will go low when the positive-going trigger pulse causes line (15) to go low. Because of feedback via A1R35 and deliberate current limitations in the output of the trigger amplifier, the output of A1U2A will remain low as long as line (18) is low. When line (16) goes low, all three lines to A1U2B are low so line (21) goes low. This condition will remain until line (18) goes high at the end of the sweep cycle.

4-98. MAIN INTEGRATOR GATE.

4-99. The main integrator gate (schematic 2) is a Schmitt trigger consisting of A1Q10 on one side and paralleled A1Q8 and A1Q9 on the other side. The two inputs are on line (21) from the main dual Schmitt to the base of A1Q9 and on line (23) from the auto and lockout circuit to the base of A1Q8.

4-100. When the MAIN AUTO/NORM switch is set to NORM, +15 volts on line (23) disables A1Q8. When line (21) goes high, the outputs of the main integrator gate (lines (24), (25), and (25A) go low.

4-101. When the MAIN AUTO/NORM switch is set to AUTO, A1Q8 is enabled and an output on line (23) from the auto and lockout circuit controls the gate. Thus the outputs of the main integrator gate on lines (24), (25), and (25A) can be controlled by inputs on either lines (21) or (23)

4-102. MAIN 10V SCHMITT.

4-103. The main 10V Schmitt (schematic 2) consists of Schmitt trigger A7Q3 and A7Q4 with current source A7Q5, emitter follower A7Q2, and lamp driver A7Q1. In the quiescent state, the output on line (18) is low. When the main integrator starts sweeping, the output from the integrator rises and eventually causes the 10V Schmitt to change states and line (18) (driven by A7Q2) goes high. As long as line (18) is high, further triggering is prohibited.

4-104. When the output of A7Q3 is low, A7Q1 is turned on and RESET lamp DSI is turned on. When the output of A7Q3 is high, A7Q1 is turned off and DSI goes out.

4-105. MAIN INTEGRATOR.

4-106. The main integrator group consists of A9Q1 through A9Q7. The group is made up of a standard Miller integrator (A9Q4 and A9Q5) with a current source (A9Q6), an operational amplifier (A9U1) for drift control, a reset control (A9Q2A and A9Q2B), current switch (A9Q1 and A9Q3), and an emitter follower (A9Q7).

4-107. Assume the circuit to be in the quiescent state with A9Q1 off and A9Q3 on. All the current from the integrating resistor is flowing in A9Q3. A trigger causes line (25) to go low and A9Q1 turns on. This causes A9Q3 to turn off, permitting the integrating capacitor to start charging toward the negative charging voltage. The ramp at the output of A9Q5 starts rising (positively).

4-108. As the ramp rises, it drives A9Q2B toward cutoff and the decreasing current in A9Q2B causes the current in A9Q2A to increase. At a time determined by the upper threshold of the main 10V Schmitt, line (25) returns to the high state and A9Q1 turns off while A9Q3 turns on. The integrating capacitor starts discharging through A9Q3. This causes the ramp at the collector of A9Q5 to start falling. As the ramp falls, the current in A9Q2B increases while the current in A9Q2A decreases. This change continues until the integrating capacitor has discharged to the point where only (and all of) the current from the integrating resistor is flowing in A9Q3, establishing a condition of equilibrium in A9Q2B and A9Q2A.

4-109. The design of the circuit is such that equilibrium is established when the base voltages of A9Q2B and A9Q2A are equal. Because the base of A9Q2A is tied to ground, equilibrium is established at 0 volt. Therefore, the reset voltage of the ramp is also 0 volt.

4-110. The voltage follower A9U3 is an operational amplifier with the base-emitter junction of A9Q5 in its feedback path. It sets the emitter of A9Q5 to approximately −6 volts. The input voltage to the integrator is a function of the −100-volt power supply. The output voltage of A9U3 is also a function of the −100-volt power supply. Therefore, the total voltage on the integrating resistor is related to the −100-volt supply. This relationship is used to cancel drift from the −100-volt supply.

4-111. A9Q7 is an emitter follower used to reduce loading on the integrator.

4-112. HOLDOFF DRIVER AND READER.

4-113. The holdoff driver (A7Q8 and A7Q9) and the holdoff reader (A7Q6 and A7Q7) function as impedance matching devices for the holdoff circuit. The holdoff charging circuit consists of the front panel HOLDOFF control R2, A7R17, and the selected holdoff capacitor on A8.

4-114. AUTO AND LOCKOUT.

4-115. The auto and lockout circuit (schematic 2) consists of A1Q7, A1CR5, and A1CR6. When the AUTO/NORM switch is set to NORM, the line- (23) input to the main integrator gate is disabled because A1Q8 is back biased by +15 volts applied through A1CR6. When the AUTO/NORM switch is set to AUTO, A1CR6 is back biased. However, as long as A1Q7 is turned on, +15 volts is applied through A1CR5 and A1Q8 remains back biased.

4-116. In the quiescent state, the NOR output of A1U2B (line (20)) is low. Incoming trigger pulses cause A1U2B to change states and line (20) goes high, charging A1C6. Because the NOR output of A1U2B has no pulldown resistor, A1C6 cannot rapidly discharge. As long as trigger pulses (40 hertz or greater) keep arriving, A1C6 does not discharge enough to permit A1Q7 to turn off.

4-117. If trigger pulses are removed, A1C6 will finally discharge to the point where A1Q7 turns off. Now, the next pulse from the 10V Schmitt will turn A1Q8 on and the resultant pulse on line (25) will initiate a sweep. In this manner, free-running is achieved in the absence of trigger pulses.

4-118. MAIN SWEEP SWITCH AND VERNIER.

4-119. The main sweep switch (schematic 7) is four-section rotary switch A8S1. The vernier circuit consists of A8U1 and front panel VERNIER control R3. Switch section A8S1A switches calibration resistors. The integrating resistors are switched by A8S1B. The integrating capacitors are switched by A8S1C. The holdoff capacitors are switched by A8S1D. A fixed voltage reference point for the integrating circuit is provided by A8U1 when the VERNIER control is in detent. It provides a variable (uncalibrated) voltage reference source when the VERNIER control is out of detent.

4-120. DELAYED TRIGGER CONDITIONER.

4-121. The delayed trigger conditioner circuits (schematic 3) consist of A1S2C, A1S2D, A1S3A, A1S3B, A1S5, and associated components. External and internal triggers are brought in on lines (34) and (35) respectively. The outputs are on lines (36) and (37) .

4-122. The delayed INT/EXT switch selects a trigger either from the oscilloscope vertical plug-in, or from some external device connected to the DELAYED EXT INPUT connector on the front panel of Model 1825A.

4-123. The DELAYED ÷1/÷10 switch connects the selected input directly or through a resistive 10:1 divider.

4-124. The DELAYED HF REJECT switch, when operated, applies a bias to the gate of A1Q11 to disable the HF impedance converter.

4-125. The DELAYED AC/DC switch connects the selected input directly or capacitively to the LF impedance converter. The HF impedance converter is always capacitively coupled through A1C7.

4-126. The DELAYED LF REJECT switch, when operated, disconnects and grounds the input to the LF impedance converter.

4-127. DELAYED IMPEDANCE CONVERTERS.

4-128. The delayed HF impedance converter (schematic 3) is a high impedance input, low impedance output, noninverting amplifier consisting of FET amplifier A1Q11 and grounded collector amplifier A1Q12. Its input is on line (36) and its output is on line (39) . The amplifier can be disabled by applying −12.6 volts to the gate of A1Q11 via A1S2C, A1S2D, A1R54 and A1R55.

4-129. The delayed LF impedance converter is a high impedance input, low impedance output, inverting amplifier consisting of operational amplifier A2U2 and emitter follower A2Q2. Its input is on line (37) and its output is on line (40) .

4-130. DELAYED TRIGGER AMPLIFIER AND POLARITY SWITCH.

4-131. The delayed trigger amplifier (schematic 3) is a two-section differential amplifier with the polarity switch between the two sections.

4-132. The input amplifier consists of differential amplifier A1U3Q1 and A1U3Q2 with current source A1U3Q3.

Inputs are from the delayed impedance converters via lines (39) and (40). Outputs are to the polarity switch via lines (41) and (42).

4-133. The polarity switch consists of two common-base amplifiers with common inputs and cross-coupled outputs. A1Q13 and A1Q16 are one amplifier pair. A1Q14 and A1Q15 are the other pair. Depending on the position of the DELAYED POS/NEG switch, one amplifier is enabled and the other is disabled. Assume that a positive-going pulse is present on line (43) and a negative-going pulse is present on line (44). Because the outputs of the two amplifiers are lattiсed, changing the position of the DELAYED POS/NEG switch will enable the other amplifier and the pulse on line (43) will be negative going while the pulse on line (44) will be positive going. The pulse polarity on lines (43) and (44) to the output amplifier section will be switched (reversed).

4-134. The output amplifier section consists of differential amplifier A1U3Q5 and A1U3Q6 with current source A1U3Q4. The setting of the adjustable resistor (A1R68) in the output of the amplifier is critical to the operation of the delayed dual Schmitt which it feeds.

4-135. DELAYED DUAL SCHMITT.

4-136. The delayed dual Schmitt (schematic 4) consists of A1U5A and A1U5B, two OR circuits with biasing and feedback to cause them to function as Schmitt triggers. The delayed dual Schmitt is controlled by pulses on lines (47) and (48) from the delayed trigger amplifier and on line (50) from the delayed control Schmitt.

4-137. In the quiescent state, the voltage on line (50) from the delayed control Schmitt is low and, assuming DELAYED POS/NEG is set to POS, line (47) is high and line (48) is low. As long as one of the three lines ((47), (48), and (50)) is high, line (51) (delayed dual Schmitt output) will be high.

4-138. The output of A1U5A will go low when a positive-going trigger pulse causes line (47) to go low. Because of feedback via A1R81 and deliberate current limitations in the output of the trigger amplifier, the output of A1U5B will remain low as long as line (50) is low. When line (48) goes low, both lines to A1U4B are low so line (51) goes low. This condition will remain until line (57) goes high at the end of the delayed sweep cycle.

4-139. DELAYED INTEGRATOR GATE.

4-140. The delayed integrator gate (schematic 4) is a Schmitt trigger consisting of A1Q17 and A1Q18. Pulses on line (51) control the state of the circuit. Its output pulse on line (54) initiates the delayed sweep.

4-141. DELAYED 10V SCHMITT AND DELAYED CONTROL SCHMITT.

4-142. The delayed 10V Schmitt is a Schmitt trigger consisting of A5Q1 and A5Q2. In the quiescent state, the output on line (57) is low. When the delayed integrator starts sweeping, the output from the integrator rises and eventually crosses the threshold of the delayed 10V Schmitt, causing it to change states and line (57) goes high. Line (51) also goes high. As long as line (50) is high, further triggering is prohibited.

4-143. Integrated circuit A1U4 functions as the delayed control Schmitt. Its purpose is to prevent triggering of the delayed integrator until after the coincident pulse from the comparator on line (61). At the end of each sweep cycle, line (57) goes high and line (50) follows. Because of feedback via A1R79, lines (61) and (50) are held high even after line (57) returns to the low state. As long as line (50) is high, line (51) is held high. At a time determined by the setting of the DELAY control, the comparator initiates a pulse and line (61) goes low. Both inputs to A1U4 being low, line (50) goes low. The next trigger pulse after the coincident pulse operates the dual Schmitt as described in paragraph 4-135.

4-144. DELAYED INTEGRATOR.

4-145. The delayed integrator consists of A5Q3 through A5Q11. The group is made up of a standard Miller integrator (A5Q8 and A5Q9) with current source (A5Q4), a reset control (A5Q6 and A5Q7), a current switch (A5Q10 and A5Q11), and two emitter followers (A5Q3 and A5Q5).

4-146. Assume the circuit to be in the quiescent state with A5Q11 off and A5Q10 on. All the current from the integrating resistor is flowing in A5Q10. A trigger causes line (54) to go low and A5Q11 turns on. This causes A5Q10 to turn off, permitting the integrating capacitor to start charging toward the negative charging voltage. The ramp at the output of A5Q8 starts rising (positively).

4-147. As the ramp rises, it drives A5Q6 toward cutoff and the decreasing current in A5Q6 causes the current in A5Q7 to increase. At a time determined by the upper threshold of the delayed 10V Schmitt, line (54) returns to the high state and A9Q11 turns off while A5Q10 turns on. The integrating capacitor starts discharging through A5Q10. This causes the ramp at the collector of A5Q8 to start falling. As the ramp falls, the current in A5Q6 increases while the current in A5Q7 decreases. This change continues until the integrating capacitor has discharged to the point where only (and all of) the current from the integrating resistor is flowing in A5Q10, establishing a condition of equilibrium in A5Q6 and A5Q7.

4-148. The design of the circuit is such that equilibrium is established when the base voltages of A5Q6 and A5Q7 are equal. In all display modes except mixed, the reference voltage at the base of A1Q7 is zero (ground). Because the base of A5Q7 is grounded, equilibrium is established at 0 volt. Therefore, the reset voltage of the ramp is also 0 volt.

4-149. In mixed mode, the main ramp from the main integrator is applied to the base of A5Q7 via line (66) . The main ramp becomes the reference voltage to which the delayed integrator resets, making the mixed display possible.

4-150. A detailed explanation of mixed mode sweep operation is described in paragraph 4-200.

4-151. DELAYED STARTS AFTER DELAY.

4-152. The delayed starts after delay circuit consists of S1 (ganged with the DELAYED TRIG LEVEL control), A1CR12 and A1CR13. The purpose of the circuit is to permit the delayed sweep to be enabled by the output of the comparator in the absence of a delayed trigger. It does this by applying ground through S6 and A1CR12 to line (47) and through S6 and A1CR13 to line (48) . This holds both lines in the low state. When line (50) goes low, line (51) goes low and the delayed integrator gate changes states to initiate the delayed sweep.

4-153. DELAYED SWEEP SWITCH.

4-154. The delayed sweep switch circuit (schematic 7) contains a rotary switch and a voltage reference source.

4-155. The rotary switch has four sections. The calibrating resistors are switched by A4S1A, the integrating resistors by A4S1B, and the integrating capacitors by A4S1C. Section A4S1D disables the delayed sweep in the OFF position of the DELAYED TIME/DIV control.

4-156. A fixed (calibrated) voltage reference source for the integrating circuits is provided by A4Q1.

4-157. INTERNAL TRIGGER PICKOFF.

4-158. The internal trigger pickoff circuits (schematic 5) provide a compensated attenuator between the trigger output and main and delayed trigger conditioners. Isolation between the two trigger conditioners is also provided.

4-159. The resistor/capacitor network in the base of A2Q3 forms the attenuator.

4-160. A2Q3 and A2Q4 are emitter followers that perform the isolation function.

4-161. The input from the vertical plug-in is on line (59) . The input to the main trigger conditioner is on line (3) . The input to the delayed trigger conditioner is on line (35)

4-162. COMPARATOR.

4-163. The comparator circuitry (schematic 6) is made up of operational amplifier A9U1, comparator A9U2A and A9U2B, Schmitt trigger A9U2C and A9U2D, and emitter follower A9U2E.

4-164. Operational amplifier A9U1 has the DELAY control in its feedback path. The output voltage is a function of the setting of the DELAY control and of the −100 volt power supply. Drift in the −100-volt power supply causes drift in the main sweep ramp and a change in the IR drop across A9R38. The change in IR drop across A9R38 caused by power supply drift is inverted at the output of A9U1,cancelling the drift in the main sweep ramp. The amount of delay is selected by setting the voltage on the base of A9U2A with calibrated DELAY control R7. The main ramp is applied on line (33) to the base of A9U3B. When the voltage of the ramp rises to equal the voltage selected by the DELAY control, a pulse is generated at the output of the comparator. The pulse is is shaped by Schmitt trigger A9U2C and A9U2D. Emitter follower A9U2E serves as isolation between the comparator and the output on line (61) to the delayed control Schmitt.

4-165. DISPLAY SWITCH.

4-166. Integrator outputs and control voltages (schematic 6) are selected by the display switch to setup the sweep modes of Model 1825A. The display switch circuitry consists of two 3-section pushbutton switches and a potentiometer. Section A3S1A, B, and C is the MAIN DISPLAY switch and A3S1D, E, and F is the DELAYED DISPLAY switch.

4-167. Inputs to the switch are: −12.6 volts, the main ramp on line (33) , and the delayed ramp on line (55) . Outputs are: main gate enable voltage (−12.6 volts) on line (64) , delayed gate enable voltage (−12.6 volts) on line (65) , delayed reset reference voltage (main ramp or ground) on line (66) , and selected ramp output on line (68) .

4-168. When neither switch is pressed, the sweep mode is in main. Switch sections A3S1D and A3S1C connect −12.6 volts to line (64) to enable the main gate. The main ramp is connected through A3S1E and A3R1 to line (68) and to the oscilloscope mainframe. The output of the delayed integrator, line (55) , is grounded through A3S1F. The delayed reset reference line (line (66)) is grounded through A3S1F.

4-169. When only the MAIN DISPLAY switch is pressed, the sweep mode is also in main. Switch section A3S1A connects −12.6 volts to line (64) to enable the main gate. All other connections are the same as in paragraph 4-168.

4-170. When only the DELAYED DISPLAY switch is pressed, the sweep mode is in delayed. Switch section A3S1D connects −12.6 volts to line (65) to enable the delayed gate. The output of the main integrator, line (33) , is disconnected by A3S1E. The output of the delayed integrator, line (55) , is connected through A3S1F and A3R1 to line (68) and to the oscilloscope mainframe. The delayed reset reference line (line (66)) is grounded through A3S1F and A3S1C.

4-171. When both switches are pressed, the sweep mode is in mixed. Switch section A3S1A connects −12.6 volts to line (64) to enable the main gate. Switch section A3S1D connected −12.6 volts to line (65) to enable the delayed gate. The output of the delayed integrator (line (55)) is connected through A3S1F and A3R1 to line (68) and the oscilloscope mainframe. The main ramp (line (33)) is connected by A3S1C and A3S1F to the delayed reset reference line (line (66)).

4-172. GATE SCHMITT AND INTENSIFY.

4-173. The purpose of the gate Schmitt and intensify circuits (schematic 5) is to form a composite gate to control the intensity grid of the oscilloscope CRT. The circuits consist of a Schmitt trigger (A1Q21 and A1Q22), an enable gate for the Schmitt trigger (A1Q20), a differential amplifier (A1Q24 and A1Q25), and two emitter follower switches (A1Q19 and A1Q23).

4-174. With no sweep (either main or delayed) in progress, both A1Q22 and A1Q25 are turned off and the output on line (63) (composite gate) is high. The oscilloscope CRT is turned off. Causing either A1Q22 or A1Q25 to turn on will decrease the voltage on line (63) and turn the CRT on. Turning both A1Q22 and A1Q25 on together will turn the CRT on harder (intensified).

4-175. In the quiescent state, A1Q22 is turned off. A1Q20 and A1Q21 are turned on. The circuit has been designed so that a pulse (square wave) from the main integrator to the base of A1Q20 will set the circuit midway between the upper and lower hysteresis limits. The Schmitt trigger is enabled and a small differentiated pulse on the base of A1Q21 will cause it to change states. The sequence of events for main mode is illustrated in figure 4-1. A1Q9 has been activated by −12.6 volts applied to the emitter. At time t_1, a pulse arrives on line (25A) from the main integrator gate. The leading edge of the pulse is differentiated in the emitter circuit of A1Q19 and applied to the base of A1Q21. Since both conditions required to activate the Schmitt trigger are present simultaneously, the Schmitt trigger changes states and the composite gate on line (63) falls. The oscilloscope CRT turns on.

4-176. Removing the main integrator gate pulse from the base of A1Q20, or applying a positive-going pulse to the base of A1Q21 will reset the Schmitt. At time t_2 (figure 4-1) the main integrator pulse is removed. The trailing edge is differentiated in the emitter circuit. Since two conditions are present, either of which will reset the Schmitt trigger, the Schmitt trigger resets and the composite gate is terminated, turning the CRT off.

4-177. In delayed mode, A1Q19 is disabled by removal of −12.6 volts from line (64) . A1Q23 is enabled by application of −12.6 volts on line (65) . The sequence of events for delayed mode is shown in figure 4-2. At t_1, the main integrator gate is applied to the base of A1Q20 via line (25A) , enabling the Schmitt trigger. Following time t_1, the main ramp is compared with a selected voltage in

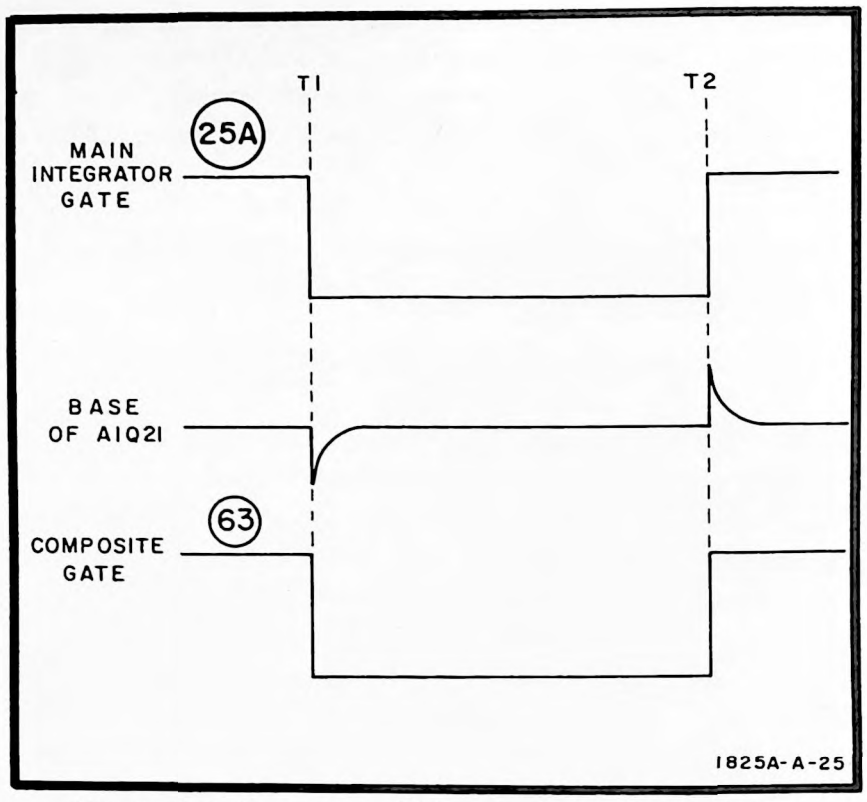

Figure 4-1. Sequence of Events, Main Mode Gate

the comparator. At time t_2, the selected voltage and the main ramp coincide and the comparator output pulse initiates an output for the delayed integrator gate. The delayed integrator gate pulse is applied on line (65) to the base of A1Q23. The pulse is differentiated and applied to the base of A1Q21. The two requirements for setting the Schmitt trigger have now been met so it changes states. The composite gate falls, turning on the CRT. Also at time t_2, A1Q24 turns off and A1Q25 turns on. This action further increases the composite gate, giving the added brightness to the CRT display required by the faster delayed sweep. At time t_3, the delayed integrator

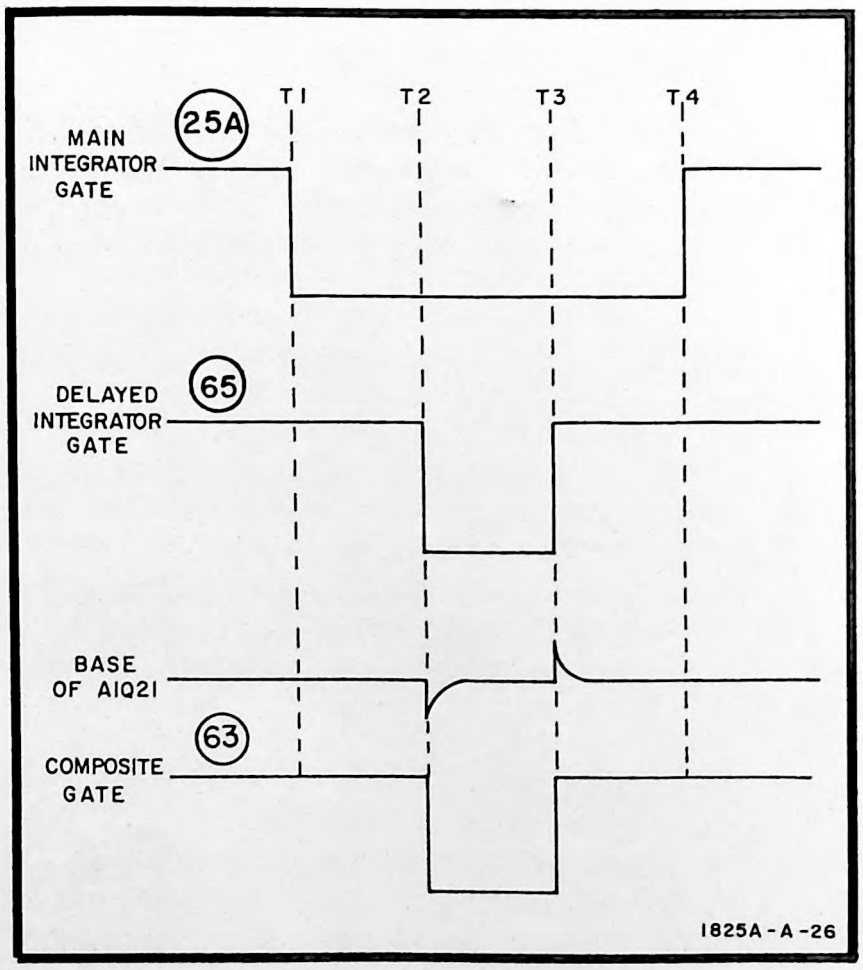

Figure 4-2. Sequence of Events, Delayed Mode Gate

gate terminates. Its trailing edge is differentiated in the emitter circuit of A1Q23 and applied to the base of A1Q21. This resets the Schmitt trigger and the differential amplifier, terminating the composite gate and turning the CRT off. The sequence of events between t_3 and t_4 continue to take place but, because the CRT has been turned off, they are not displayed.

4-178. In mixed mode, both A1Q19 and A1Q23 are activated by application of −12.6 volts on lines (64) and (65) . The sequence of events for mixed mode is illustrated in figure 4-3. At time t_1, the main integrator gate is applied via line (25A) to the base of A1Q19, enabling the Schmitt trigger. The leading edge of the main integrator gate pulse is differentiated in the emitter circuit of A1Q23 and applied to the base of A1Q21. Since both conditions for setting the Schmitt trigger are simultaneously applied, the Schmitt trigger changes states. The composite gate falls and the CRT turns on. Following time t_1, the main ramp is compared with a selected voltage in the comparator. At time t_2, the selected voltage and the main ramp coincide and the comparator output pulse initiates an output from the delayed integrator gate. The delayed integrator gate is applied on line (65) to the base of A1Q23. Since the Schmitt trigger is already set, the differentiated pulse on the base of A1Q21 has no effect, however the delayed integrator gate on line (65) turns A1Q24 off and A1Q25 on. This action increases the composite gate and the brightness (intensification) of the CRT. At time t_3, the delayed integrator gate terminates. The trailing edge is differentiated in the emitter circuit of A1Q33 and applied to the base of A1Q21. The Schmitt trigger resets, terminating the composite gate and turning the CRT off. The sequence of events between t_3 and t_4 continue to take place but, because the CRT is turned off, the events are not displayed.

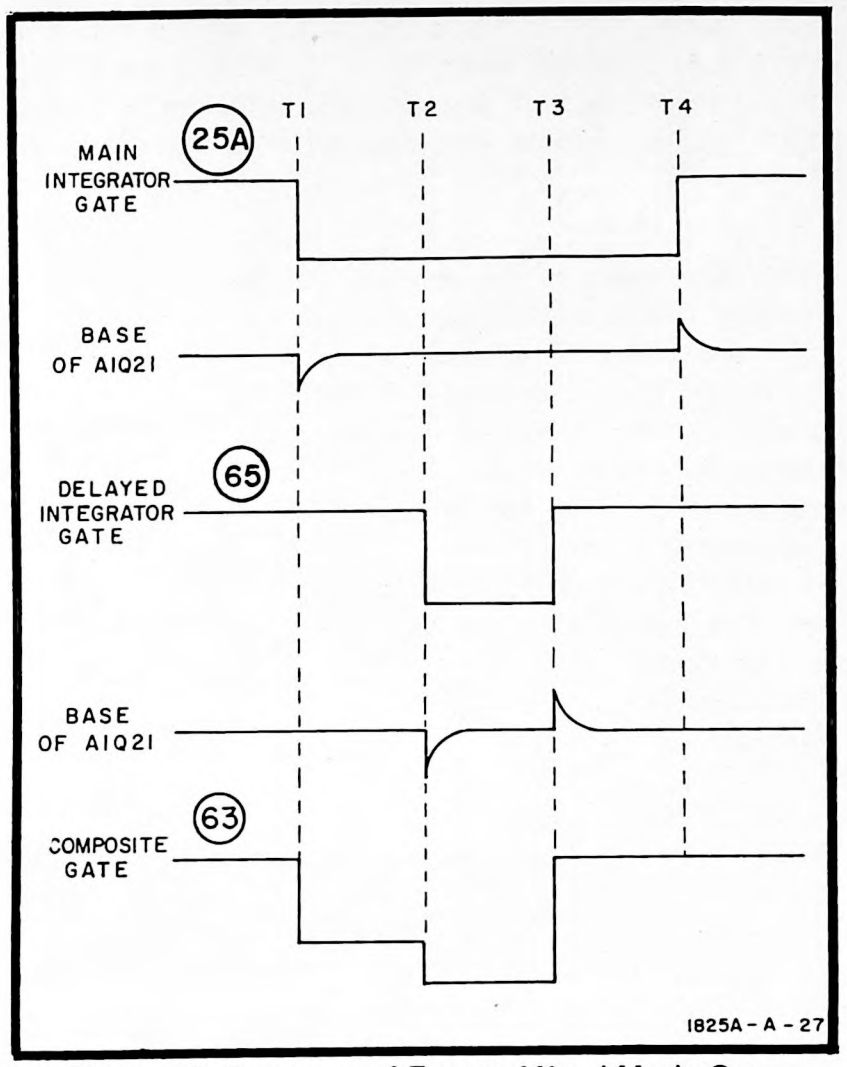

Figure 4-3. Sequence of Events, Mixed Mode Gate

4-179. CIRCUIT OPERATION.

4-180. The information in the following paragraphs is provided in order to tie together all the information presented previously in this section. This is accomplished by following certain functions through a complete cycle of operation.

4-181. MAIN INTEGRATOR OPERATION IN NORM.

4-182. This discussion can be followed on schematic 2 and, in less detail, on the block diagram.

4-183. Setting the MAIN AUTO/NORM switch to NORM disables the line - (23) input to the main integrator gate (base of A1Q8). Assume all circuits to be in the quiescent state. Lines (15) and (18) are low. Line (16) is high.

4-184. A positive-going trigger pulse is received, causing line (16) to go low. Because all three inputs (lines (15) , (16) , and (18)) are now low, the output (line (21)) goes low. The main integrator gate changes states and line (25) goes low. The low condition on line (25) turns A9Q1 on. A9Q1 takes the current formerly flowing into A9Q3, unclamping the integrator and permitting the main ramp to rise.

4-185. As the ramp rises, it is connected through holdoff driver (A7Q8 and A7Q9) and holdoff reader (A7Q6 and A7Q7) to the main 10V Schmitt, causing it to change states. Line (18) goes high, causing line (21) to go high. The main integrator gate changes states and line (25) goes high. A9Q1 turns off and the integrating capacitor discharges through A9Q3, terminating the ramp.

4-186. The trigger holdoff timing circuit keeps the output of the holdoff reader high for a length of time determined by setting of HOLDOFF control R2. During this time, the main 10V Schmitt remains in its set state. The high condition on line (18) keeps the main dual Schmitt disabled, and retriggering of the sweep is prevented.

4-187. Finally, the holdoff timing circuit discharges to the point where the output of the holdoff reader passes through the lower threshold of the main 10V Schmitt. The main 10V Schmitt resets, and line (18) returns to the low state. The next positive-going trigger transition will operate the main dual Schmitt and the entire cycle will repeat.

4-188. FREE-RUN MAIN INTEGRATOR OPERATION.

4-189. The purpose of free-run operation is to provide a visible trace on the oscilloscope CRT in the absence of

trigger pulses. To start this discussion, assume that the MAIN AUTO/NORM switch is set to AUTO, the sweep has just been triggered, but there are no further incoming trigger pulses. Follow this discussion on schematic 2.

4-190. All inputs to the main dual Schmitt are low, so the NOR output of A1U1B (line (20)) is high. The auto and lockout (A1Q7) is turned on and applying a disabling bias to the line - (23) input to the main integrator gate (base of A1Q8). The ramp rises and causes the main 10V Schmitt to change states. Line (18) goes high. The NOR output of A1U1B has no pulldown resistor so line (20) cannot go low immediately. At the end of the hold-off period, the main 10V Schmitt resets and line (18) goes low. The output of the auto and lockout ramps downward on line - (23) , finally crossing the threshold of the main integrator gate and causing line (25) to go low. This again starts the ramp. As long as no trigger pulses occur, line (20) cannot go high and the main 10V Schmitt will trigger the line - (23) input to the main integrator gate.

4-191. TRIGGERED MAIN INTEGRATOR OPERATION IN AUTO.

4-192. See schematic 2. Assume that the circuit is free-running as described in paragraph 4-187. An incoming trigger causes all inputs to the main dual Schmitt to go low and consequently, line (20) goes high. When line (20) is high, the auto and lockout disables the line - (23) input to the main integrator gate and free-running cannot occur. When one or more inputs to the main dual Schmitt goes high, line (20) cannot go low for about 25 milliseconds because the capacitor (A1C6) must discharge through a finite resistance. As long as trigger pulses continue to arrive, the auto and lockout will keep the line - (23) input to the main integrator gate disabled. The discharge time of the auto and lockout charging circuit is such that trigger pulse frequencies above approximately 40 hertz will retrigger the sweep before A1C6 can discharge.

4-193. SINGLE SWEEP.

4-194. Turn to schematic 2. Normally the main 10V Schmitt is set by the rising main ramp and reset at the end of the holdoff time. When the SINGLE switch is pressed, the lower hysteresis limit of the Schmitt is shifted. It will set normally upon application of the ramp but will not reset at the end of the holdoff time. Pushing the RESET button will momentarily restore the original lower hysteresis limit and permit the main 10V Schmitt to reset.

4-195. DELAYED INTEGRATOR OPERATION IN DELAYED MODE.

4-196. This discussion can be followed on schematic 4 and in less detail, on the block diagram.

4-197. Assume all circuits to be in the quiescent state. Lines (57) and (47) are low. Lines (61) , (50) , and (48) are high.

4-198. At a time determined by the setting of the DELAY control, a pulse is received on line (61) from the comparator. Because both inputs to A1U4 have gone low, its output (line (50)) goes low. Both inputs to A1U5A are now low, so its output goes low. When a trigger pulse arrives, line (48) goes low. Both inputs to A1U5B are now low so its output (line (51)) goes low. This sets the delayed integrator gate and line (54) goes low. The low state on line (54) causes A5Q11 to turn on. Transistor A5Q11 draws the current formerly drawn through A5Q10. This action unclamps the integrator and the ramp rises.

4-199. As the ramp rises, it crosses the lower threshold (on line (67)) of the delayed 10V Schmitt, causing it to set. Line (57) goes high and resets all Schmitts in the path to line (54) . Line (54) goes low and terminates the ramp. As the ramp falls, the delayed 10V Schmitt resets and line (57) goes low. This condition will remain until another comparator pulse arrives, followed by a trigger pulse. If the DELAYED TRIG LEVEL control has been set to DELY'D STARTS AFTER DELAY, lines (47) and (48) are held in the low state by a ground through A1CR12, A1CR13, and S6. In that case, no trigger pulses are required and the circuit is activated solely by the coincident pulse on line (61) from the comparator.

4-200. MIXED MODE SWEEP OPERATION.

4-201. This discussion can be followed on schematics 2, 4, 5, and 6. The sequence of events is illustrated in figure 4-4.

4-202. Because the delayed integrator is able to function both as a voltage follower (linear amplifier with a gain of 1) and as an integrator, it is possible to take the composite ramp from the output of the delayed integrator.

4-203. The action starts with the generation of the main integrator gate. At time t_1, the output of the main integrator gate circuit (line (25) on schematic 2) falls and initiates the main ramp. The main ramp is routed on line

(33) (schematic 6) through the display switch and then on line (66) to the base of A5Q7 (schematic 4). At this time, the delayed integrator is clamped and will operate as a voltage follower. The main ramp on the base of A5Q7 appears on the composite ramp line (line (55)).

4-204. At time t_2, the coincident pulse from the comparator triggers the delayed integrator gate which unclamps the delayed integrator. At this time, the reference voltage for the delayed integrator is point X (figure 4-4) on the main ramp. Therefore the delayed ramp starts rising from that point.

4-205. At time t_3, the delayed sweep terminates but can fall only to the delayed reference point which, at this time, is point Y on the main ramp (figure 4-4). The events between t_3 and t_4 continue but, because the oscilloscope CRT turns off at the termination of the delayed integrator gate (figure 4-3 and paragraph 4-178) they are not displayed.

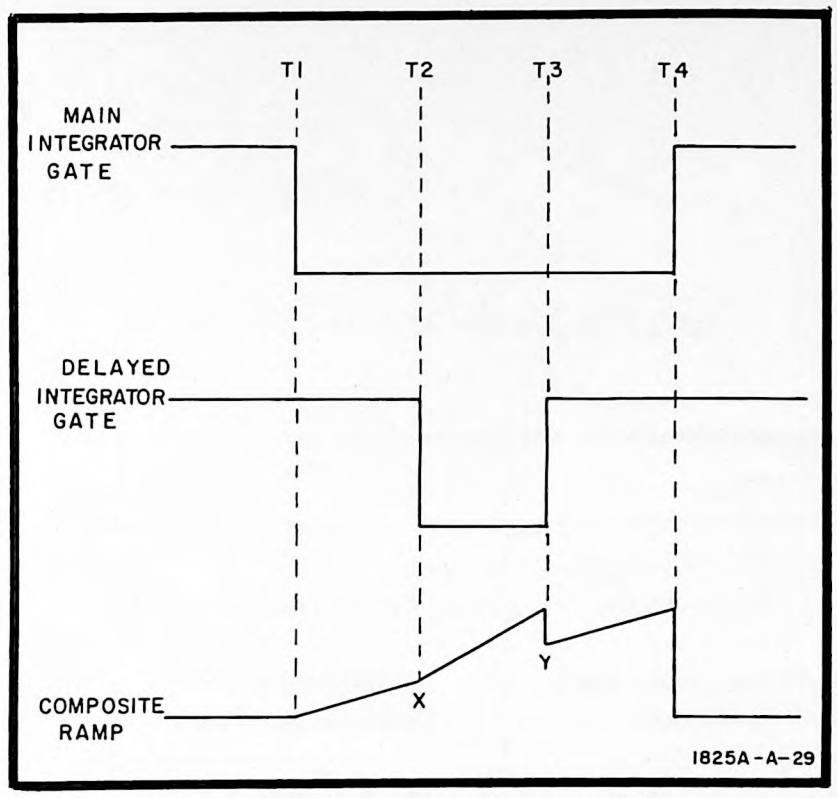

Figure 4-4. Sequence of Events, Mixed Mode Sweep Operation

Table 5-1. Recommended Test Equipment

Type	Model	Characteristics	For
Oscilloscope Mainframe	HP 180-series	No substitute	Performance checks Adjustments
Oscilloscope Vertical	HP Model 1808A, or Model 1805A	Dual-channel, 100-MHz	Performance check Adjustments
Monitor Oscilloscope	HP 180-series with plug-ins	General-purpose, 100-MHz	Performance checks
Oscillator	HP Model 200C/D	40-Hz to 1-kHz	Performance checks Adjustments
VHF Oscillator	HP Model 3200B	150-MHz	Performance checks
Attenuator	GR 874G20	20-dB, 150-MHz	Performance checks Adjustments
Sampling Voltmeter	HP Model 3406A	50-mV, 50-kHz to 150-MHz	Performance checks
Time Mark Generator	HP Model 226A	50-ns to 1-sec time marks	Performance checks Adjustments
Power Divider	HP 11549A	50-ohm, 150-MHz	Performance checks
Sampling Tee	HP 11063A	Accommodate sampling probe,	Performance checks
50-ohm Termination	HP 10100C	50-ohm, 150-MHz	Performance checks
8-in. BNC Cable (2)	HP 10121A	50-ohm, BNC male to BNC male	Performance checks Adjustments
36-in. BNC Cable (2)	HP 10122A	50-ohm, BNC male to BNC male	Performance checks Adjustments
BNC Tee	HP 1250-0781	50-ohm	Performance checks Adjustments

SECTION V

PERFORMANCE CHECK AND ADJUSTMENTS

5-1. INTRODUCTION.

5-2. This section contains step-by-step procedures for checking Model 1825A specifications as listed in Section I. A table (performance check record) is provided at the end of the performance checks for recording measurements taken during the first running of the procedures. The record can be used to compare measurements taken at later dates with the original. Procedures for calibrating the instrument follow the performance checks. A photograph showing the locations of the internal adjustment controls is located at the end of the section.

5-3. The procedures assume that the instrument will perform as specified. Should there be a failure to obtain the required result during either the check-out or adjustment procedure, the cause should be found and corrected before proceeding further.

5-4. The procedures assume that the user will have on hand, either the recommended test equipment listed in table 5-1, or equivalent test equipment. Required characteristics for equivalent test equipment are also listed in table 5-1. If the user's application does not require that Model 1825A meet all its listed specifications, then less accurate test equipment can be used for some of the procedures or some can be omitted. Unless the recommended test equipment is on hand, the procedures and test setups may require modification to adapt them to available equipment. Refer any questions regarding the procedures to the nearest Hewlett-Packard Sales/ Service Office (addresses in back of this manual).

5-5. PERFORMANCE CHECKS.

5-6. The following paragraphs describe procedures to determine if the instrument meets the listed specifications. These procedures can be used as part of an incoming inspection, as a periodic operational check, or to check calibration after repairs and adjustments are made.

5-7. The first time the performance checks are made, enter the results on the performance check record. Be sure to enter the instrument serial number for identification. Remove the record and file it for future reference.

5-8. PRELIMINARY OPERATIONAL CHECKS.

5-9. REQUIRED RESULT. All basic functions shall be operational.

5-10. PROCEDURE. To make preliminary operational checks, proceed as follows:

a. Install Model 1825A and vertical plug-in and perform initial turn-on procedure as described in Section III.

b. Allow 30-minute warm-up period.

c. Press black DISPLAY pushbutton. Ensure that gray DISPLAY pushbutton is out.

d. Set DELAYED TIME/DIV to OFF.

e. Rotate MAIN TIME/DIV through all positions. Trace shall be visible at all sweep speeds. There shall be no delayed intensified sections on trace.

f. Release black DISPLAY pushbutton.

g. Press gray DISPLAY pushbutton.

h. Set DELAYED TRIG LEVEL to DLY'D STARTS AFTER DELAY.

i. Rotate DELAYED TIME/DIV switch through all positions. Trace shall be visible at each sweep speed.

j. Release gray DISPLAY pushbutton.

k. Set MAIN TIME/DIV to 50 uSEC.

l. Set DELAYED TIME/DIV to 5 uSEC.

m. Rotate DELAY dial from ccw position to cw position. Intensified line, approximately 1 division long, shall move from left to right on trace.

n. Set Model 1825A controls as follows:

MAIN TIME/DIV	.1 mSEC
DELAYED TIME/DIV.....	20 uSEC
AUTO/NORM	AUTO
DELAYED TRIG LEVEL	DLY'D STARTS AFTER DELAY
pushbuttons not mentioned	out

o. Set DELAY dial to move start of intensified portion of trace to center of graticule.

p. Press black and gray DISPLAY pushbuttons. Left half of trace shall be unintensified. Right half shall be intensified.

q. Release gray DISPLAY pushbutton.

r. Turn INTENS RATIO fully ccw. There shall be no intensified portion on trace.

s. Readjust INTENS RATIO for desired contrast.

t. Rotate VERNIER out of detent. UNCAL indicator shall light.

u. Return VERNIER to detent.

v. Set MAIN TIME/DIV to 50 mSEC.

w. Press SINGLE pushbutton. There shall be no display on CRT.

x. Press RESET. One sweep shall occur. RESET indicator shall light during sweep.

y. Refer to Section VIII and appropriate block in troubleshooting block diagram in case of failure of any of the above checks. Failure to sweep in AUTO is most likely caused by defect in integrator or associated circuitry. Failure to sweep in NORM (with trigger applied) is most likely to be caused by defect in triggering circuitry.

5-11. MAIN TRIGGER LEVEL BALANCE.

5-12. REQUIRED RESULT. **Main triggering shall be stable in both polarities with 100-mV peak-to-peak signal.**

5-13. PROCEDURE. To check main trigger level balance, proceed as follows:

a. Connect equipment as shown in figure 5-1.

b. Set vertical controls as follows:

display switch	chan A
sync source	chan A
chan A sensitivity	0.1 V/div

c. Set Model 1825A controls as follows:

DISPLAY	MAIN
MAIN TIME/DIV	.5 mSEC
AUTO/NORM	AUTO
MAIN INT/EXT	EXT
MAIN TRIG LEVEL	12:00
pushbuttons not mentioned	out

d. Adjust oscillator for 1-kHz, 1 div display.

e. Adjust vertical position to center display.

f. Check stability of triggering in both positions of MAIN POS/NEG switch.

g. Should above check fail, check voltages at center tap of MAIN TRIG LEVEL control R1 and inputs and outputs of A2U1 and A2Q1 (schematic 1).

5-14. MAIN LOW FREQUENCY REJECT.

5-15. REQUIRED RESULT. A 750-Hz signal shall be attenuated below triggering level when the MAIN LF REJECT pushbutton is depressed.

5-16. PROCEDURE. To check low frequency reject, proceed as follows:

a. Connect equipment as shown in figure 5-1.

b. Set vertical controls as follows:

display switch	chan A
sync source	chan A
chan A sensitivity	0.02 V/div

c. Set Model 1825A controls as follows:

DISPLAY	MAIN
MAIN TIME/DIV	.5 mSEC
AUTO/NORM	NORM
MAIN INT/EXT	EXT
pushbuttons not mentioned	out

d. Adjust oscillator for 750-Hz, 3-div display.

e. Adjust MAIN TRIG LEVEL for stable display.

f. Depress MAIN LF REJECT.

g. Vary MAIN TRIG LEVEL. Triggering shall not occur.

h. If triggering occurs, check trigger recognition threshold in adjustment paragraphs.

5-17. MAIN HIGH FREQUENCY REJECT.

5-18. REQUIRED RESULT. A 300 kHz signal shall be attenuated below triggering level when the MAIN HF REJECT pushbutton is depressed.

5-19. PROCEDURE. To check main high frequency reject, proceed as follows:

a. Connect equipment as shown in figure 5-1.

b. Set vertical controls as follows:

display switch ..... chan A
sync source ..... chan A
chan A sensitivity ..... 0.02 V/div

c. Set Model 1825A controls as follows:

DISPLAY..... MAIN
MAIN TIME/DIV ..... 1 uSEC
AUTO/NORM ..... NORM
MAIN INT/EXT ..... EXT
pushbuttons not mentioned ..... out

d. Set oscillator for 300-kHz, 3-div display.

e. Adjust MAIN TRIG LEVEL for stable display.

f. Depress MAIN HF REJECT.

g. Vary MAIN TRIGGER LEVEL. Triggering shall not occur.

h. If triggering occurs check trigger recognition threshold in adjustment paragraphs.

5-20. MAIN RANGE AND POLARITY.

5-21. REQUIRED RESULT. In MAIN ÷1, triggering point shall adjust smoothly to both positive and negative extremes of a 4-volt peak-to-peak waveform. Triggering shall occur on appropriate slope as indicated by MAIN POS/NEG switch. In MAIN ÷10, the peak-to-peak trigger point shall occur over a 40V peak-to-peak waveform.

5-22. PROCEDURE. To check range and polarity, proceed as follows:

a. Connect equipment as shown in figure 5-2.

b. Set vertical controls as follows:

display switch ..... chan A
sync source ..... chan A
chan A sensitivity 1V/div

c. Set Model 1825A controls as follows:

DISPLAY..... MAIN
MAIN TIME/DIV ..... 2 mSEC
MAIN ÷1/÷10 ..... ÷1
AUTO/NORM ..... NORM
MAIN INT/EXT ..... EXT
MAIN AC/DC ..... AC
MAIN POS/NEG ..... NEG
pushbuttons not mentioned ..... out

d. Set oscillator for 1 kHz, 4-div display.

e. Rotate MAIN TRIG LEVEL. Trigger point shall adjust smoothly along entire negative slope of waveform.

f. Set MAIN POS/NEG to POS.

g. Rotate MAIN TRIGGER LEVEL. Triggering point shall adjust smoothly along entire positive slope of waveform.

h. Should tests in steps e and g fail, check lines 1 through 16 on troubleshooting block diagram in Section VIII.

i. Set MAIN ÷1/÷10 to ÷10.

CAUTION

Before proceeding to next step, ensure that maximum permissible input to vertical plug-in is at least 40V. If not, install attenuator between BNC tee and vertical input (figure 5-2).

j. Change output of oscillator to 40V p-p.

k. Rotate MAIN TRIGGER LEVEL. Trigger point shall adjust smoothly along entire positive slope of waveform.

l. Should test in step k fail, check voltage divider A1R2/A1R3 (schematic 1).

5-23. MAIN HIGH FREQUENCY TRIGGERING.

5-24. REQUIRED RESULT. In MAIN INT, triggering shall be stable for 1/2 division and greater between dc and 100 MHz. In MAIN EXT, triggering shall be stable on 50 mV peak-to-peak signals between dc and 50 MHz, increasing to 100 mV at 100 MHz, and increasing to 150 mV at 150 MHz.

5-25. PROCEDURE. To check main high frequency triggering, proceed as follows:

a. Connect equipment as shown in figure 5-3.

b. Set vertical controls as follows:

display switch ..... chan A
sync source ..... chan A
chan A sensitivity ..... 1 V/div

c. Set Model 1825A controls as follows:

DISPLAY..... MAIN
MAIN TIME/DIV ..... .05 uSEC
MAIN INT/EXT ..... INT
AUTO/NORM ..... NORM
MAIN LF REJECT ..... depressed
pushbuttons not mentioned ..... out

d. Set mainframe MAGNIFIER to X10.

Note

If upper bandwidth limit of vertical plug-in being used in less than 100 MHz, reduce frequency appropriately for INT trigger check.

e. Set VHF oscillator for 100 MHz, 1/2 div display.

f. Adjust MAIN TRIG LEVEL. Display shall be stable.

g. Change MAIN INT/EXT to EXT.

h. Set VHF oscillator to 50 MHz. Adjust amplitude for 180 mV rms (50 mV p-p at EXT INPUT) as read on sampling voltmeter.

i. Adjust MAIN TRIG LEVEL. Display shall be stable.

j. Set VHF oscillator for 100 MHz. Adjust amplitude for 360 mV rms (100 mV p-p at EXT INPUT) as read on sampling voltmeter.

k. Adjust MAIN TRIG LEVEL. Display shall be stable.

l. Set VHF oscillator to 150 MHz. Adjust amplitude for 540 mV rms (150 mV p-p at EXT INPUT) as read on sampling voltmeter.

m. Adjust MAIN TRIG LEVEL. Display shall be stable.

n. Should any of the above checks fail, first check trigger recognition threshold in the adjustment paragraphs. Then check high frequency response of HF impedance converter and trigger amplifier (schematic 1).

5-26. DELAYED TRIGGER LEVEL BALANCE.

5-27. REQUIRED RESULT. Delayed triggering shall be stable in both polarities with 100 mV peak-to-peak signal.

5-28. PROCEDURE. To check delayed trigger level balance, proceed as follows:

a. Connect equipment as shown in figure 5-4.

b. Set vertical controls as follows:

display switch	chan A
sync source	chan A
chan A sensitivity	0.02V/div

c. Set Model 1825A controls as follows:

DISPLAY	DELAYED
MAIN TIME/DIV	.5 mSEC
DELAYED TIME/DIV	.2 mSEC
AUTO/NORM	AUTO
MAIN INT/EXT	INT
DELAYED INT/EXT	EXT
MAIN TRIG LEVEL	12:00
DELAY dial	0.30
pushbuttons not mentioned	out

d. Adjust oscillator for 1-kHz, 1-div display.

e. Adjust vertical position to center display.

f. Check stability of triggering in both positions of DELAYED POS/NEG switch.

g. Should above check fail, check voltages at center tap of DELAYED TRIG LEVEL control R5 and inputs and outputs of A2U2 and A2Q2 (schematic 3).

5-29. DELAYED LOW FREQUENCY REJECT.

5-30. REQUIRED RESULT. A 750-kHz signal shall be attenuated below triggering level when the DELAYED LF REJECT pushbutton is depressed.

5-31. PROCEDURE. To check low frequency reject, proceed as follows.

a. Connect equipment as shown in figure 5-4.

b. Set vertical controls as follows:

display switch	chan A
sync source	chan A
chan A sensitivity	0.02V/div

c. Set Model 1825A controls as follows:

DISPLAY	DELAYED
MAIN TIME/DIV	.5 mSEC
DELAYED TIME/DIV	.2 mSEC
AUTO/NORM	AUTO
MAIN INT/EXT	INT
DELAYED INT/EXT	EXT
MAIN TRIG LEVEL	12:00
DELAY dial	0.30
pushbuttons not mentioned	out

d. Set oscillator for 750-Hz, 3-div display.

e. Adjust DELAYED TRIG LEVEL for stable display.

f. Depress DELAYED LF REJECT.

g. Vary DELAYED TRIG LEVEL. Triggering shall not occur.

h. If triggering occurs, check trigger recognition threshold in adjustment paragraphs.

5-32. DELAYED HIGH FREQUENCY REJECT.

5-33. REQUIRED RESULT. A 300-kHz signal shall be attenuated below triggering level when the DELAYED HF REJECT pushbutton is depressed.

5-34. PROCEDURE. To check delayed high frequency reject, proceed as follows:

a. Connect equipment as shown in figure 5-4.

b. Set vertical controls as follows:

display switch	chan A
sync source	chan A
chan A sensitivity	0.02V/div

c. Set Model 1825A controls as follows:

DISPLAY	DELAYED
MAIN TIME/DIV	2 uSEC
DELAYED TIME/DIV	1 uSEC
AUTO/NORM	AUTO
MAIN INT/EXT	INT
DELAYED INT/EXT	EXT
MAIN TRIG LEVEL	12:00
DELAY DIAL	0.30
pushbuttons not mentioned	out

d. Set oscillator for 300-kHz, 3-div display.

e. Adjust DELAYED TRIG LEVEL for stable display.

f. Depress DELAYED HF REJECT.

g. Vary DELAYED TRIG LEVEL. Triggering shall not occur.

h. If triggering occurs, check trigger recognition threshold in adjustment paragraphs.

5-35. DELAYED RANGE AND POLARITY.

5-36. REQUIRED RESULT. In DELAYED ÷1, triggering point shall adjust smoothly to both positive and negative extremes of a 4-volt peak-to-peak waveform. Triggering shall occur on appropriate slope as indicated by DELAYED POS/NEG switch. In DELAYED ÷10, the peak-to-peak trigger point shall occur over only the center 30 degrees of the DELAYED TRIG LEVEL control.

5-37. PROCEDURE. To check delayed range and polarity, proceed as follows:

a. Connect equipment as shown in figure 5-5.

b. Set vertical controls as follows:

display switch	chan A
sync source	chan A
chan A sensitivity	1 V/div

c. Set Model 1825A controls as follows:

DISPLAY	DELAYED
MAIN TIME/DIV	.5 mSEC
DELAYED TIME/DIV	.2 mSEC
DELAYED ÷1/÷10	÷1
MAIN INT/EXT	INT
DELAYED INT/EXT	EXT
MAIN TRIG LEVEL	12:00
DELAYED AC/DC	AC
DELAYED POS/NEG	NEG
DELAY dial	0.30
pushbuttons not mentioned	out

d. Set oscillator for 1-kHz, 4-div display.

e. Rotate DELAYED TRIG LEVEL. Triggering point shall adjust smoothly along entire negative slope of waveform.

f. Set DELAYED POS/NEG to POS.

g. Rotate DELAYED TRIG LEVEL. Triggering point shall adjust smoothly along entire positive slope of waveform.

h. Should tests in steps e and g fail, check lines 6 through 22 in troubleshooting block diagram in Section VIII.

i. Set DELAYED ÷1/÷10 to ÷10.

CAUTION

Before proceeding to next step, ensure that maximum permissible input to vertical plug-in is at least 40V. If not, install attenuator between BNC tee and vertical input (figure 5-5).

j. Change output of oscillator to 40V p-p.

k. Rotate DELAYED TRIG LEVEL. Triggering point shall adjust smoothly over center 30° of waveform.

l. Should test in step k fail, check voltage divider A1R52/A1R53 (schematic 3).

5-38. DELAYED HIGH FREQUENCY TRIGGERING.

5-39. REQUIRED RESULT. In DELAYED INT, triggering shall be stable for 1/2 division and greater between dc and 100 MHz. In DELAYED EXT, triggering shall be stable on 50-mV peak-to-peak signals between dc and 50 MHz increasing to 100 mV at 100 MHz, and increasing to 150 mV at 150 MHz.

5-40. PROCEDURE. To check delayed high frequency triggering, proceed as follows:

a. Connect equipment as shown in figure 5-3.

b. Set vertical controls as follows:

display switch	chan A
sync source	chan A
chan A sensitivity	1 V/div

c. Set Model 1825A controls as follows:

DISPLAY	MAIN
MAIN TIME/DIV	.05 uSEC
DELAYED TIME/DIV	.05 uSEC
MAIN INT/EXT	INT
DELAYED INT/EXT	INT
AUTO/NORM	NORM
DELAY dial	0.30
pushbuttons not mentioned	out

d. Set mainframe MAGNIFIER to X10.

Note

If upper bandwidth limit of vertical plug-in being used is less than 100 MHz, reduce frequency appropriatly for INT trigger check.

e. Set VHF oscillator for 100-MHz, 1/2-div display.

f. Adjust MAIN TRIG LEVEL. Display shall be stable.

g. Set DISPLAY to DELAYED.

h. Adjust DELAYED TRIG LEVEL.

i. Change DELAYED INT/EXT to EXT.

j. Set VHF oscillator to 50 MHz. Adjust amplitude for 180 mV rms (50 mV p-p at EXT INPUT) as read on sampling voltmeter.

k. Set DISPLAY to MAIN.

l. Adjust MAIN TRIG LEVEL. Display shall be stable.

m. Set DISPLAY to DELAYED.

n. Adjust DELAYED TRIG LEVEL. Display shall be stable.

o. Set VHF oscillator to 100 MHz. Adjust amplitude for 360 mV rms (100 mV p-p at EXT INPUT) as read on sampling voltmeter.

p. Set DISPLAY to MAIN.

q. Adjust MAIN TRIG LEVEL. Display shall be stable.

r. Set DISPLAY to DELAYED.

s. Adjust DELAYED TRIG LEVEL. Display shall be stable.

t. Set VHF oscillator to 150 MHz. Adjust amplitude for 540 mV rms (150 mV p-p at EXT INPUT) as read on sampling voltmeter.

u. Set DISPLAY to MAIN.

v. Adjust MAIN TRIG LEVEL. Display shall be stable.

w. Set DISPLAY to DELAYED.

x. Adjust DELAYED TRIG LEVEL. Display shall be stable.

y. Should any of the above checks fail, first check trigger recognition threshold in the adjustment paragraphs. Then check high frequency response of HF impedance converter and trigger amplifier (schematic 3).

5-41. AUTO TRIGGERING.

5-42. REQUIRED RESULT. Frequency cutoff for automatic triggering shall be no greater than 40 Hz.

5-43. PROCEDURE. To check auto triggering, proceed as follows:

a. Connect equipment as shown in figure 5-2.

b. Set vertical controls as follows:

display switch	chan A
sync source	chan A
chan A sensitivity	1 V/div

c. Set Model 1825A controls as follows:

DISPLAY ..... MAIN
MAIN TIME/DIV ..... 20 mSEC
MAIN INT/EXT ..... INT
AUTO/NORM ..... NORM
pushbuttons not mentioned ..... out

d. Set oscillator for 40-Hz, 6-div display.

e. Adjust MAIN TRIG LEVEL. Display shall be stable.

f. Set AUTO/NORM to AUTO. Display shall remain stable.

g. Should above test fail, check A1Q7 (schematic 2).

5-44. REAR PANEL GATE AND SWEEP OUTPUTS.

5-45. REQUIRED RESULT. The amplitudes of the rear panel gate outputs shall be ≥0.5 volt. The amplitudes of the rear panel sweep outputs shall be ≥1 volt.

5-46. PROCEDURE. To check rear panel gate and sweep outputs, proceed as follows:

a. Connect equipment as shown in figure 5-7.

b. Set Model 1825A controls as follows:

DISPLAY ..... MAIN
MAIN TIME/DIV ..... 10 mSEC
AUTO/NORM ..... AUTO
pushbuttons not mentioned ..... out

c. Monitor main gate output at rear of 180-series mainframe. Amplitude of pulses shall be equal to or greater than 0.5 volt peak-to-peak.

d. Monitor sweep output at rear of 180-series mainframe. Amplitude of ramp shall be equal to or greater than 1 volt peak-to-peak.

e. Set Model 1825A controls as follows:

DISPLAY ..... DELAYED
DELAYED TIME/DIV ..... 10 uSEC
AUTO/NORM ..... AUTO
pushbuttons not mentioned ..... out

f. Monitor delayed gate output at rear of 180-series mainframe. Amplitude of pulses shall be equal to or greater than 0.5 volt peak-to-peak.

g. Monitor sweep output at rear of 180-series mainframe. Amplitude of ramp shall be equal to or greater than 1 volt peak-to-peak.

5-47. SWEEP HOLDOFF.

5-48. REQUIRED RESULT. Sweep holdoff shall be variable from 15 ms ±30% to >80 ms.

5-49. PROCEDURE. To check sweep holdoff, proceed as follows:

a. Connect equipment as shown in figure 5-7.

b. Set Model 1825A controls as follows:

DISPLAY ..... MAIN
MAIN TIME/DIV ..... 1 mSEC
AUTO/NORM ..... AUTO
HOLDOFF ..... ccw (detent)
pushbuttons not mentioned ..... out

c. Monitor sweep output at rear of 180-series mainframe. Observe time between end of one sweep and beginning of next. Holdoff shall be 15 ms ±30%.

d. Rotate TRIGGER HOLDOFF fully cw. Holdoff shall increase to 80 ms or greater.

e. Should above checks fail, check R2, A7R17, and A8C11 (schematic 2).

5-50. MAIN SWEEP TIME.

5-51. REQUIRED RESULT. All sweep ranges shall be accurate ±3%.

5-52. PROCEDURE. To check main sweep time, proceed as follows:

a. Connect equipment as shown in figure 5-8.

b. Set vertical controls as follows:

display switch ..... chan A
sync source ..... chan A
chan A sensitivity ..... 1 V/div

c. Set Model 1825A controls as follows:

DISPLAY ..... MAIN
MAIN TIME/DIV ..... .05 uSEC
AUTO/NORM ..... AUTO
pushbuttons not mentioned ..... out

d. Set time-mark generator for 50-ns marker output.

e. Adjust display on CRT so start of first time mark is exactly on left edge of graticule. Eleventh time mark shall fall on right edge of graticule ±1.5 minor div.

f. This completes step 1 of table 5-2. Complete remaining steps in table.

Table 5-2. Main Sweep Time Checks

Step	Time Marks	MAIN TIME/DIV
1	50 ns	.05 uSEC
2	.1 usec	.1 uSEC
3	.2 usec	.2 uSEC
4	.5 usec	.5 uSEC
5	1 usec	1 uSEC
6	2 usec	2 uSEC
7	5 usec	5 uSEC
8	10 usec	10 uSEC
9	20 usec	20 uSEC
10	50 usec	50 uSEC
11	.1 ms	.1 mSEC
12	.2 ms	.2 mSEC
13	.5 ms	.5 mSEC
14	1 ms	1 mSEC
15	2 ms	2 mSEC
16	5 ms	5 mSEC
17	10 ms	10 mSEC
18	20 ms	20 mSEC
19	50 ms	50 mSEC
20	.1 sec	.1 SEC
21	.2 sec	.2 SEC
22	.5 sec	.5 SEC
23	1 sec	1 SEC

g. Should any sweep time checks fail, check sweep calibration in adjustment paragraphs.

5-53. SWEEP VERNIER.

5-54. REQUIRED RESULT. Vernier shall reduce distance between adjacent pulses at least 2.5 times.

5-55. PROCEDURE. To check sweep vernier, proceed as follows:

a. Connect equipment as shown in figure 5-8.

b. Set vertical controls as follows:

display switch ..... chan A
sync source ..... chan A
chan A sensitivity ..... 1 V/div

c. Set Model 1825A controls as follows:

DISPLAY..... MAIN
MAIN TIME/DIV ..... 1 mSEC
AUTO/NORM..... AUTO
MAIN INT/EXT..... INT
pushbuttons not mentioned ..... out

d. Set time-mark generator for 10-ms marker output.

e. Turn VERNIER ccw.

f. Observe display. Distance between adjacent pulses shall be less than 4 div.

g. Should above test fail, check VERNIER R3 and A8U1 (schematic 7).

5-56. DELAY ACCURACY.

5-57. REQUIRED RESULT. The differential delay between two events, as read on the DELAY dial, shall be accurate ±0.75%, ±0.4 division of the DELAY dial.

5-58. PROCEDURE. To check delay accuracy, proceed as follows:

a. Connect equipment as shown in figure 5-8.

b. Set vertical controls as follows:

display switch ..... chan A
sync source ..... chan A
chan A sensitivity ..... 1 V/div

c. Set Model 1825A controls as follows:

DISPLAY..... DELAYED
MAIN TIME/DIV ..... .05 uSEC
DELAYED TIME/DIV..... .05 uSEC
MAIN INT/EXT..... INT
DELAY dial 1.00
pushbuttons not mentioned ..... out

d. Set MAGNIFIER on mainframe to X10.

e. Set time-mark generator for 50 ms marker.

f. Using horizontal position control, set marker precisely on horizontal center of graticule.

g. Turn DELAY dial to 9.00 and locate marker.

h. Using DELAY dial, set marker precisely on horizontal center of graticule.

i. Read DELAY dial. Dial shall be between 8.92 and 9.08.

j. This completes step 1 in table 5-3. Complete remaining steps in table.

k. Should any delay accuracy check fail, check appropriate main sweep adjustment step in adjustment paragraphs.

5-59. DELAYED SWEEP TIME.

5-60. REQUIRED RESULT. All delayed sweep ranges shall be accurate within ±3%.

5-61. PROCEDURE. To check delayed sweep time, proceed as follows:

a. Connect equipment as shown in figure 5-8.

b. Set vertical controls as follows:

display switch ..... chan A
sync source ..... chan A
chan A sensitivity ..... 1 V/div

c. Set Model 1825A controls as follows:

DISPLAY..... DELAYED
DELAYED TIME/DIV..... .05 uSEC
AUTO/NORM ..... AUTO
MAIN INT/EXT..... INT
DELAYED INT/EXT ..... INT
DELAY dial 1.00
pushbuttons not mentioned ..... out

d. Set time-mark generator for 50 ns marker.

e. Adjust display on CRT so start of first time mark is exactly on left edge of graticule. Eleventh time mark shall be on right edge of graticule ±1.5 minor div.

f. This completes step 1 in table 5-4. Complete remaining steps in table.

g. Should any sweep time check fail, check appropriate sweep calibration step in adjustment paragraphs.

Table 5-3. Delay Accuracy Checks

Step	Markers	MAIN TIME/DIV	DELAYED TIME/DIV
1	50 ms	.05 uSEC	.05 uSEC
2	0.1 usec	.1 uSEC	.05 uSEC
3	0.2 usec	.2 uSEC	.05 uSEC
4	0.5 usec	.5 uSEC	.05 uSEC
5	1 usec	1 uSEC	.1 uSEC
6	2 usec	2 uSEC	.2 uSEC
7	5 usec	5 uSEC	.5 uSEC
8	10 usec	10 uSEC	1 uSEC
9	20 usec	20 uSEC	2 uSEC
10	50 usec	50 uSEC	5 uSEC
11	0.1 ms	.1 mSEC	10 uSEC
12	0.2 ms	.2 mSEC	20 uSEC
13	0.5 ms	.5 mSEC	50 uSEC
14	1 ms	1 mSEC	.1 mSEC
15	2 ms	2 mSEC	.2 mSEC
16	5 ms	5 mSEC	.5 mSEC
17	10 ms	10 mSEC	1 mSEC
18	20 ms	20 mSEC	2 mSEC
19	50 ms	50 mSEC	5 mSEC
20	0.1 sec	.1 SEC	10 mSEC
21	0.2 sec	.2 SEC	20 mSEC
22	0.5 sec	.5 SEC	20 mSEC*
23	1 sec	1 SEC	10 mSEC**

*Change magnifier on mainframe to X5.
**Change magnifier on mainframe to X1.

5-62. DELAY TIME JITTER.

5-63. REQUIRED RESULT. Delay time jitter shall not exceed 0.002% of the maximum delay on each range.

Table 5-4. Delayed Sweep Time Checks

Step	Time Marks	DELAYED TIME/DIV
1	50 ns	.05 uSEC
2	.1 usec	.1 uSEC
3	.2 usec	.2 uSEC
4	.5 usec	.5 uSEC
5	1 usec	1 uSEC
6	2 usec	2 uSEC
7	5 usec	5 uSEC
8	10 usec	10 uSEC
9	20 usec	20 uSEC
10	50 usec	50 uSEC
11	.1 ms	.1 mSEC
12	.2 ms	.2 mSEC
13	.5 ms	.5 mSEC
14	1 ms	1 mSEC
15	2 ms	2 mSEC
16	5 ms	5 mSEC
17	10 ms	10 mSEC
18	20 ms	20 mSEC

5-64. PROCEDURE. To check delay time jitter, proceed as follows:

a. Connect equipment as shown in figure 5-8.

b. Set vertical controls as follows:

display switch ..... chan A
sync source ..... chan A
chan A sensitivity ..... 1 V/div

c. Set Model 1825A controls as follows:

DISPLAY..... DELAYED
MAIN TIME/DIV ..... 50 uSEC
DELAYED TIME/DIV..... 1 uSEC
DELAY dial 9.00
pushbuttons not mentioned ..... out

d. Set MAGNIFIER on mainframe to X10.

e. Set time-mark generator for 50-usec marker.

f. Locate marker with DELAY dial.

g. Observe jitter on leading edge. Horizontal jitter shall not exceed 1 div.

PERFORMANCE CHECK RECORD

MODEL 1825A

Instrument Serial Number _____ **Date** _____

Check	Specification	Measured
PRELIMINARY OPERATIONAL CHECKS:		
Main Sweep Ranges	Sweeps, all ranges	_____
Delayed Sweep Ranges	Sweeps, all ranges	_____
Intensification	1 div intensified	_____
Delay	Half trace intensified	_____
Intensity ratio	INTENS RATIO controls intensity	_____
UNCAL Indicator	Lamp lights	_____
Single Sweep	One sweep, lamp lights	_____
MAIN TRIGGER LEVEL BALANCE:		
Positive	Stable display at 100 mV	_____
Negative	Stable display at 100 mV	_____
MAIN LOW FREQUENCY REJECT:	No triggering at 750 Hz	_____
MAIN HIGH FREQUENCY REJECT:	No triggering at 300 kHz	_____
MAIN RANGE AND POLARITY:		
÷1	4V p-p	_____
÷10	40V p-p	_____
MAIN HIGH FREQUENCY TRIGGERING:		
INT	Stable display at 1/2 div	_____
EXT 50 MHz	50 mV p-p	_____
100 MHz	100 mV p-p	_____
150 MHz	150 mV p-p	_____

PERFORMANCE CHECK RECORD (cont'd)

MODEL 1825A

Instrument Serial Number _____ **Date** _____

Check	Specification	Measured
DELAYED TRIGGER LEVEL BALANCE:		
Positive	Stable display at 100 mV	_____
Negative	Stable display at 100 mV	_____
DELAYED LOW FREQUENCY REJECT:	No triggering at 750 Hz	_____
DELAYED HIGH FREQUENCY REJECT:	No triggering at 300 kHz	_____
DELAYED RANGE AND POLARITY:		
÷1	4V p-p	_____
÷10	40V p-p	_____
DELAYED HIGH FREQUENCY TRIGGERING:		
INT	Stable display at 1/2 div	_____
EXT 50 MHz	50 mV p-p	_____
100 MHz	100 mV p-p	_____
150 MHz	150 mV p-p	_____
AUTO TRIGGERING:	Cutoff <40 Hz	_____
REAR PANEL GATE AND SWEEP OUTPUTS:		
Main gate	≥0.5V p-p	_____
sweep	≥1V p-p	_____
Delayed gate	≥0.5V p-p	_____
sweep	≥1V p-p	_____

PERFORMANCE CHECK RECORD (cont'd)

MODEL 1825A

Instrument Serial Number _____ **Date** _____

Check		Specification	Measured
SWEEP HOLDOFF:			
ccw		15 ms ±30%	_____
cw		>80 ms	_____
MAIN SWEEP TIME: (position of last time marker)			
.05 uSEC		±3%	_____
.1 uSEC		±3%	_____
.2 uSEC		±3%	_____
.5 uSEC		±3%	_____
1 uSEC		±3%	_____
2 uSEC		±3%	_____
5 uSEC		±3%	_____
10 uSEC		±3%	_____
20 uSEC		±3%	_____
50 uSEC		±3%	_____
.1 mSEC		±3%	_____
.2 mSEC		±3%	_____
.5 SEC		±3%	_____
1 mSEC		±3%	_____
2 mSEC		±3%	_____
5 mSEC		±3%	_____
10 mSEC		±3%	_____
20 mSEC		±3%	_____
50 mSEC		±3%	_____
.1 SEC		±3%	_____
.2 SEC		±3%	_____
.5 SEC		±3%	_____
1 SEC		±3%	_____
SWEEP VERNIER:		2-4 div	_____
DELAY ACCURACY:	Step 1	8.92-9.08	_____
	Step 2	8.92-9.08	_____
	Step 3	8.92-9.08	_____
	Step 4	8.92-9.08	_____
	Step 5	8.92-9.08	_____
	Step 6	8.92-9.08	_____
	Step 7	8.92-9.08	_____
	Step 8	8.92-9.08	_____
	Step 9	8.92-9.08	_____
	Step 10	8.92-9.08	_____
	Step 11	8.92-9.08	_____
	Step 12	8.92-9.08	_____
	Step 13	8.92-9.08	_____
	Step 14	8.92-9.08	_____
	Step 15	8.92-9.08	_____
	Step 16	8.92-9.08	_____
	Step 17	8.92-9.08	_____
	Step 18	8.92-9.08	_____

PERFORMANCE CHECK RECORD (cont'd)

MODEL 1825A

Instrument Serial Number _____ **Date** _____

Check		Specification	Measured
DELAY ACCURACY (Cont/d)	Step 19	8.92-9.08	
	Step 20	8.92-9.08	
	Step 21	8.92-9.08	
	Step 22	8.92-9.08	
	Step 23	8.92-9.08	
DELAYED SWEEP TIME:	.05 uSEC	±3%	
	.1 uSEC	±3%	
	.2 uSEC	±3%	
	.5 uSEC	±3%	
	1 uSEC	±3%	
	2 uSEC	±3%	
	5 uSEC	±3%	
	10 uSEC	±3%	
	20 uSEC	±3%	
	50 uSEC	±3%	
	.1 mSEC	±3%	
	.2 mSEC	±3%	
	.5 mSEC	±3%	
	1 mSEC	±3%	
	2 mSEC	±3%	
	5 mSEC	±3%	
	10 mSEC	±3%	
	20 mSEC	±3%	
DELAY TIME JITTER:		≤1 div	

5-65. ADJUSTMENTS.

5-66. The following paragraphs describe procedures to calibrate the instrument so it will perform as specified in Section I. For complete calibration, the procedure should be performed in sequence. Individual adjustments can be made by following the steps in the appropriate paragraphs. Adjustment controls are shown on a fold-out illustration at the end of this section.

5-67. Remove mainframe covers and Model 1825A cover before installing Model 1825A in the mainframe. Turn instrument on and allow 1/2 hour warm-up time. Use a nonmetallic screwdriver to make adjustments. Read the introduction to this section before starting the adjustment procedures. After adjustments are completed, check instrument performance by accomplishing the performance checks described earlier in this section.

5-68. MAIN TRIGGER RECOGNITION THRESHOLD.

5-69. REFERENCE. Table 5-1, figures 5-6, 5-9, and schematic 1.

5-70. PROCEDURE. To adjust main trigger recognition threshold, proceed as follows:

a. Connect equipment as shown in figure 5-6.

b. Set Model 1825A controls as follows:

DISPLAY	MAIN
MAIN TIME/DIV	1 mSEC
MAIN INT/EXT	EXT
AUTO/NORM	NORM
pushbuttons not mentioned	out

c. Set oscillator for 10 MHz, 50 mV rms output.

d. Turn MAIN TRIGGER SENSITIVITY adjust A1R25 fully cw.

e. Turn MAIN TRIG LEVEL back and forth through 0 while turning MAIN TRIGGER SENSITIVITY adjust A1R25 slowly ccw. Continue turning A1R25 until one sweep occurs when MAIN TRIG LEVEL is rotated in either direction.

f. Reduce output of oscillator to 42 mV rms.

g. Rotate MAIN TRIG LEVEL back and forth through 0. Sweep shall occur in only one direction of rotation.

h. Should step g fail, adjust A1R25 cw until sweep occurs in only one direction of rotation.

5-71. DELAYED TRIGGER RECOGNITION THRESHOLD.

5-72. REFERENCE. Table 5-1, figures 5-6, 5-9, and schematic 3.

5-73. PROCEDURE. To adjust delayed trigger recognition threshold, proceed as follows:

a. Connect equipment as shown in figure 5-6.

b. Set Model 1825A controls as follows:

DISPLAY	DELAYED
DELAYED TIME/DIV	.1 mSEC
DELAYED INT/EXT	EXT
AUTO/NORM	AUTO

c. Set oscillator for 10 MHz, 50 mV rms output.

d. Turn DELAYED TRIGGER SENSITIVITY adjust cw.

e. Turn DELAYED TRIG LEVEL back and forth through 0 while turning DELAYED TRIGGER SENSITIVITY adjust A1R68 slowly ccw. Continue turning A1R68 until one sweep occurs when DELAYED TRIG LEVEL is rotated in either direction.

f. Reduce output of oscillator to 42 mV rms.

g. Rotate DELAYED TRIG LEVEL back and forth through 0. Partial sweep should occur in only one direction of rotation.

h. Should step g fail, adjust A1R68 cw until partial sweep occurs in only one direction of rotation.

i. Repeat check in step e.

5-74. SWEEP INTERFACE ADJUSTMENT.

5-75. REFERENCE. Table 5-1, figure 5-9, and schematic 6.

5-76. PROCEDURE. To make the sweep interface adjustment, proceed as follows:

a. Set Model 1825A controls as follows:

DISPLAY	MAIN
MAIN TIME/DIV	50 uSEC
DELAYED TIME/DIV	1 uSEC
DELAY dial	1.00
pushbuttons not mentioned	out

b. Using horizontal position control, set intensified dot 1 div from left edge of graticule.

c. Set DELAY dial to 9.00.

d. Adjust SWEEP INTERFACE ADJUST A3R1 to place start of intensified portion of sweep 1 div from right edge of graticule.

5-77. PRELIMINARY MAIN SWEEP ADJUSTMENT.

5-78. REFERENCE. Tables 5-1, 5-5, figures 5-8, 5-9, and schematic 7.

5-79. PROCEDURE. To make preliminary main sweep adjustments, proceed as follows:

a. Connect equipment as shown in figure 5-8.

b. Set vertical controls as follows:

display switch ..... chan A
sync source ..... chan A
chan A sensitivity ..... 1 V/div

c. Set Model 1825A controls as follows:

DISPLAY..... MAIN
MAIN TIME/DIV ..... 1 uSEC
pushbuttons not mentioned ..... out

d. Set time-mark generator for 0.1-usec markers.

e. Using horizontal position control, set first marker to left edge of graticule.

f. Adjust A8C3 to place eleventh time marker on right edge of graticule.

g. This completes step l in table 5-5. Complete remaining steps in table.

Table 5-5. Preliminary Sweep Adjustment

Step	Time Marks	MAIN TIME/DIV	Adjust
1	0.1 usec	.1 uSEC	A8C3
2	1 usec	1 uSEC	A8R16
3	50 usec	50 uSEC	A8R4
4	5 ms	5 mSEC	A8R3
5	0.5 sec	.5 SEC	A8R1

5-80. MAIN SWEEP ADJUSTMENT.

5-81. REFERENCE. Tables 5-1, 5-6, figures 5-8, 5-9, and schematic 7.

5-82. PROCEDURE. To make main sweep adjustments, proceed as follows:

a. Connect equipment as shown in figure 5-8.

b. Set Vertical controls as follows:

display switch ..... chan A
sync source ..... chan A
chan A sensitivity ..... 0.2 V/div

c. Set Model 1825A controls as follows:

DISPLAY..... DELAYED
MAIN TIME/DIV ..... .1 uSEC
DELAYED TIME/DIV..... .05 uSEC
pushbuttons not mentioned ..... out

d. Set time-mark generator for 0.1 usec marker.

e. Set MAGNIFIER on mainframe to X10.

f. Set DELAY dial to 1.00.

g. Center pulse vertically on graticule.

h. Using horizontal position control, set leading edge of pulse to horizontal center of graticule.

i. Set DELAY dial to 9.00.

j. Adjusting A8C3, set leading edge of pulse to horizontal center of graticule.

k. Repeat steps f through j until leading edge of pulse can be set to horizontal center of graticule with DELAY dial set between 8.96 and 9.04.

l. Change MAIN TIME/DIV to .2 uSEC.

m. Set time-mark generator for 0.2 usec marker.

n. Set DELAY dial to 1.00.

o. Using horizontal position control, set leading edge of pulse to horizontal center of graticule.

p. Set DELAY dial near 9.00. Verify that leading edge of pulse can be centered with DELAY dial set between 8.96 and 9.04.

q. If requirement in step p is not met, make compromise adjustment of A8C3 that will satisfy requirement in step p and still satisfy requirement in step k.

r. Change MAIN TIME/DIV to .05 uSEC.

s. Set DELAY dial to 1.00.

t. Using horizontal position control, set leading edge of pulse to horizontal center of graticule.

u. Set DELAY dial near 9.00. Verify that leading

Table 5-6. Main Sweep Calibration

Step	Time Marks	MAIN TIME/DIV	DELAYED TIME/DIV	Adjust
1	0.2 usec	.2 uSEC	.05 uSEC	A8C3
2	.1 usec	.1 uSEC	.05 uSEC	Check 8.96-9.04
3	50 ns	.05 uSEC	.05 uSEC	Check 8.96-9.04
4	0.5 usec	.5 uSEC	.05 uSEC	A8R16
5	1 usec	1 uSEC	.1 uSEC	Check 8.92-9.02
6	2 usec	2 uSEC	.2 uSEC	Check 8.92-9.02
7	5 usec	5 uSEC	.5 uSEC	A8R4 8.92-9.02
8	10 usec	10 uSEC	1 uSEC	Check 8.92-9.02
9	20 usec	20 uSEC	2 uSEC	Check 8.92-9.02
10	50 usec	50 uSEC	5 uSEC	Check 8.92-9.02
11	0.1 ms	.1 mSEC	10 uSEC	Check 8.92-9.02
12	0.2 ms	.2 mSEC	20 uSEC	Check 8.92-9.02
13	0.5 ms	.5 mSEC	50 uSEC	A8R3
14	1 ms	1 mSEC	.1 mSEC	Check 8.92-902
15	2 ms	2 mSEC	.2 mSEC	Check 8.92-9.02
16	5 ms	5 mSEC	.5 mSEC	Check 8.92-9.02
17	10 ms	10 mSEC	1 mSEC	Check 8.92-9.02
18	20 ms	20 mSEC	2 mSEC	Check 8.92-9.02
19	50 ms	50 mSEC	5 mSEC	A8R1
20	0.1 sec	.1 SEC	10 mSEC	Check 8.92-9.02
21	0.2 sec	.2 SEC	20 mSEC	Check 8.92-9.02
22	0.5 sec	.5 SEC	20 mSEC*	Check 8.96-9.04
23	1 sec	1 SEC	20 mSEC*	Check 8.96-9.04

*Note
For last two steps, change magnifier on mainframe to X5.

edge of pulse can be centered with DELAY dial set between 8.96 and 9.04.

v. If requirement in step u is not met, make compromise adjustment of A8C3 that will satisfy requirement of step u and still satisfy requirements of steps k and p.

w. This completes steps 1, 2, and 3 in table 5-6. Complete remaining steps in table. Note that calibration tolerances are different for three fastest speeds and two slowest speeds.

5-83. SWEEP GAIN.

5-84. REFERENCE. Table 5-1, figures 5-8, 5-9, and schematic 6.

5-85. PROCEDURE. To set sweep gain, proceed as follows:

a. Connect equipment as shown in figure 5-8.

b. Set vertical controls as follows:

display	chan A
sync source	chan A
chan A sensitivity	1 V/div

c. Set Model 1825A controls as follows:

DISPLAY	MAIN
MAIN TIME/DIV	10 uSEC
pushbuttons not mentioned	out

d. Set time mark generator for 10-usec marker.

e. Using horizontal position control, set first marker on left edge of graticule.

f. Set SWEEP INTERFACE adjust A3R1 to set eleventh marker on right edge of graticule.

5-86. DELAYED SWEEP TIMING.

5-87. REFERENCE. Tables 5-1, 5-7, figures 5-8, 5-9, and schematic 7.

5-88. PROCEDURE. To calibrate delayed sweep timing, proceed as follows:

a. Connect equipment as shown in figure 5-8.

b. Set vertical controls as follows:

display switch	chan A
sync source	chan A
chan A sensitivity	1 V/div

c. Set Model 1825A controls as follows:

DISPLAY	DELAYED
DELAYED TIME/DIV	.05 uSEC
MAIN TIME/DIV	.1 uSEC
DELAY dial	0.30
pushbuttons not mentioned	out

d. Set time mark generator for 0.05 usec markers.

e. Using horizontal position control, set first time marker on left edge of graticule.

f. Adjusting A4C3, set eleventh time marker on right edge of graticule.

g. Using conditions listed in table 5-7, steps 2 through 6, check accuracy of next five ranges. Eleventh time marker must fall on right edge of graticule ±1 minor div.

h. If any range fails to meet requirement of step g, make compromise adjustment of A4C3 that will satisfy step g and still satisfy requirements for other five ranges controlled by A4C3.

i. This completes steps 1 through 6 in table 5-7. Complete remaining steps in table.

Table 5-7. Delayed Sweep Calibration

Step	Time Marks	MAIN TIME/DIV	DELAYED TIME/DIV	Adjust
1	0.05 usec	.1 uSEC	.05 uSEC	A4C3
2	0.1 usec	.2 uSEC	.1 uSEC	Check
3	0.2 usec	.5 uSEC	.2 uSEC	Check
4	0.5 usec	1 uSEC	.5 uSEC	Check
5	1 usec	2 uSEC	1 uSEC	Check
6	2 usec	5 uSEC	2 uSEC	Check
7	5 usec	10 uSEC	5 uSEC	A4R4
8	10 usec	20 uSEC	10 uSEC	Check
9	20 usec	50 uSEC	20 uSEC	Check
10	0.1 ms	.2 mSEC	.1 mSEC	Check
11	0.2 ms	.5 mSEC	.2 mSEC	Check
12	0.5 ms	1 mSEC	.5 mSEC	A4R2
13	1 ms	2 mSEC	1 mSEC	Check
14	2 ms	5 mSEC	2 mSEC	Check
15	5 ms	10 mSEC	5 mSEC	Check
16	10 ms	20 mSEC	10 mSEC	Check
17	20 ms	50 mSEC	20 mSEC	Check

ep Calibration

7	DELAYED TIME/DIV	Adjust
	.05 uSEC	A4C3
	.1 uSEC	Check
	.2 uSEC	Check
	.5 uSEC	Check
	1 uSEC	Check
	2 uSEC	Check
	5 uSEC	A4R4
	10 uSEC	Check
	20 uSEC	Check
	.1 mSEC	Check
	.2 mSEC	Check
	.5 mSEC	A4R2
	1 mSEC	Check
	2 mSEC	Check
	5 mSEC	Check
	10 mSEC	Check
	20 mSEC	Check

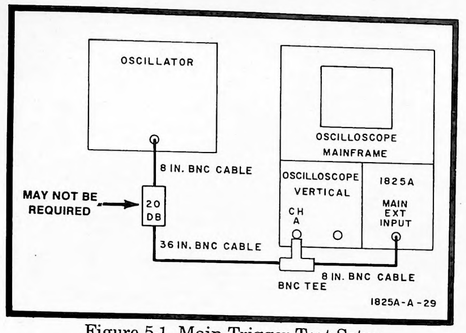

Figure 5-1. Main Trigger Test Setup

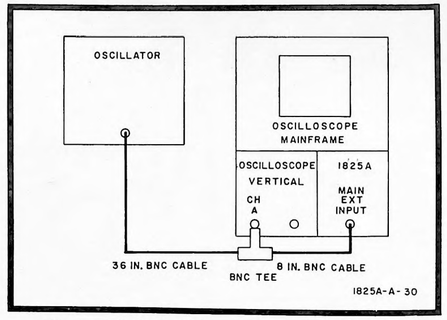

Figure 5-2. Main Trigger Range Test Setup

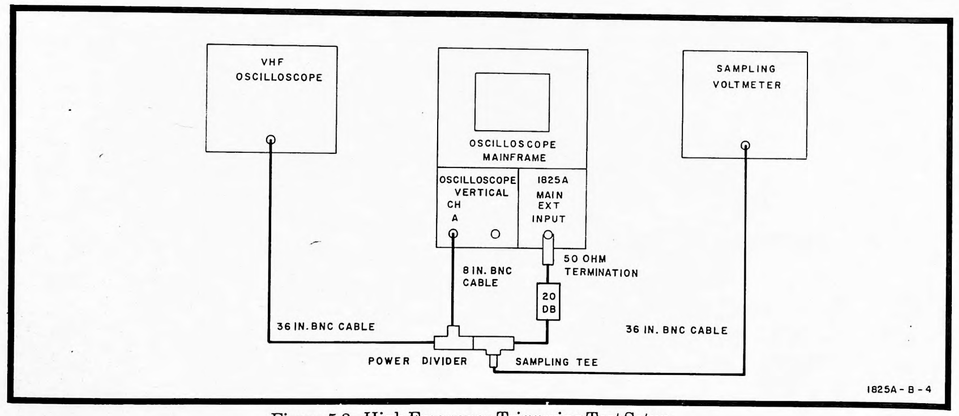

Figure 5-3. High Frequency Triggering Test Setup

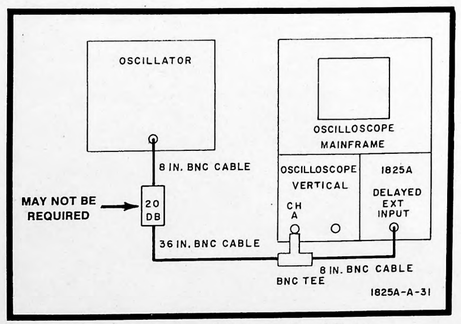

Figure 5-4. Delayed Trigger Test Setup

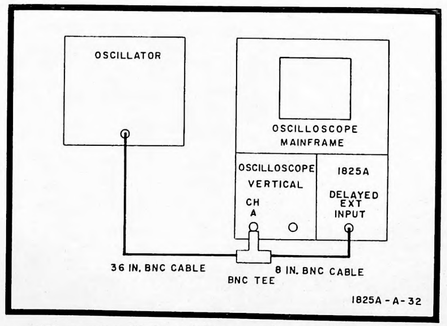

Figure 5-5. Delayed Trigger Range Test Setup

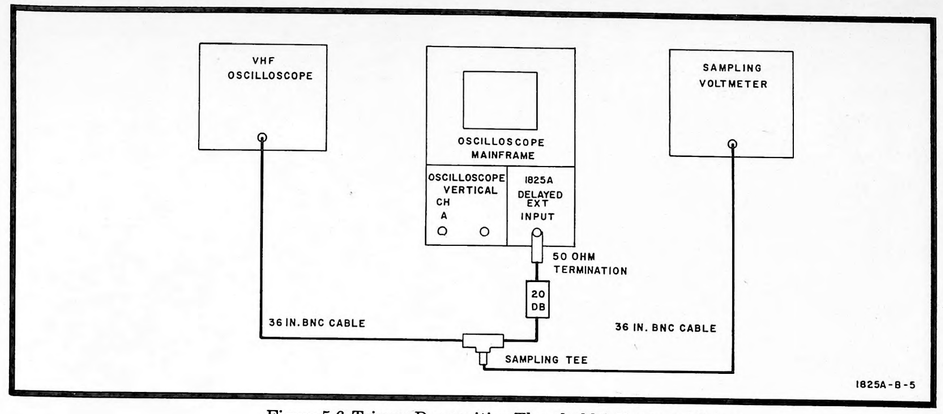

Figure 5-6. Trigger Recognition Threshold Adjustment Setup

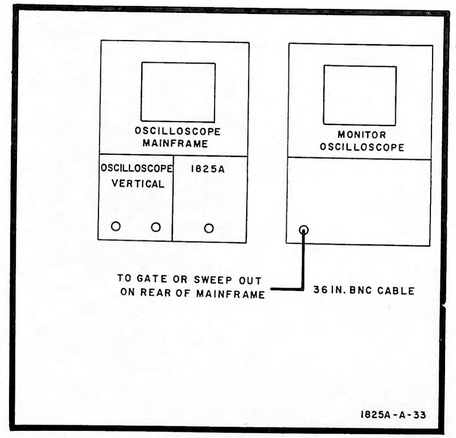

Figure 5-7. Rear Panel Outputs Test Setup

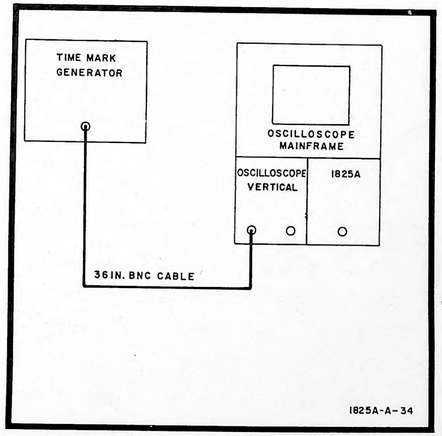

Figure 5-8. Sweep Calibration Test Setup

ADJUSTMENT CONTROLS ON OTHER SIDE

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marker

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eventl

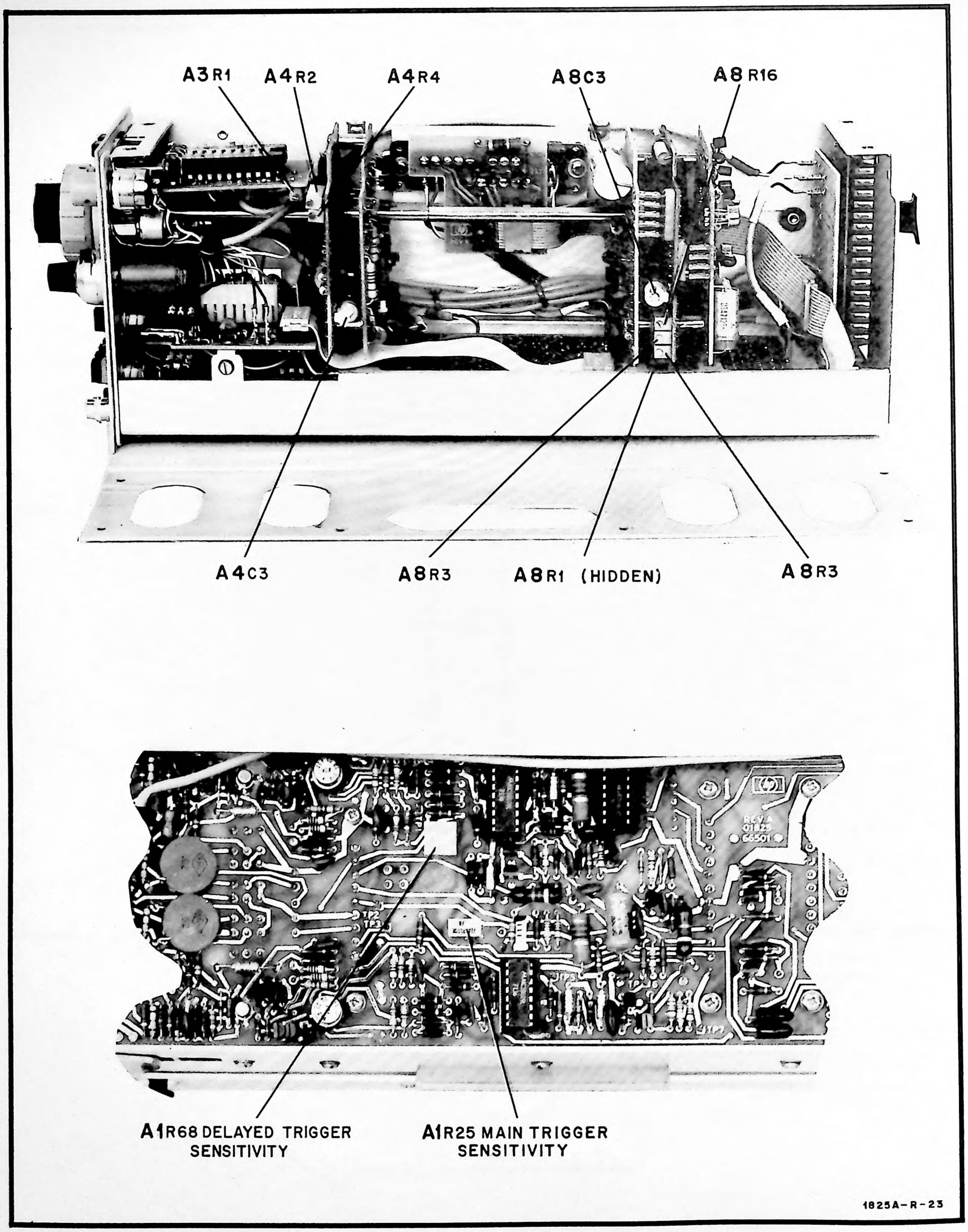
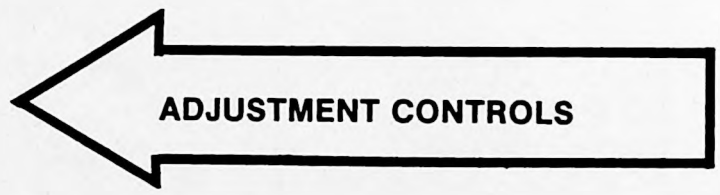


Figure 5-9. Model 1825A Adjustment Controls


ADJUSTMENT CONTROLS

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. The abbreviations used in the parts list are described in table 6-1. Table 6-2 lists the parts in alphanumeric order by reference designator and includes the manufacturer and manufacturer's part number. Table 6-3 contains the list of manufacturers' codes.

6-3. ORDERING INFORMATION.

6-4. To obtain replacement parts from Hewlett-Packard, address order or inquiry to the nearest Hewlett-Packard Sales/Service Office and supply the following information:

a. Instrument model and serial number.

b. HP part number of item(s).

c. Quantity of part(s) desired.

d. Reference designator of part(s).

6-5. To order a part not listed in the table, provide the following information:

a. Instrument model and serial number.

b. Description of the part, including function and location in the instrument.

c. Quantity desired.

Table 6-1. Abbreviations for Replaceable Parts List

A	AMPERE(S)	H	HENRY(IES)	NPN	NEGATIVE-POSITIVE-NEGATIVE	RWV	REVERSE WORKING VOLTAGE
ASSY	ASSEMBLY	HG	MERCURY	NSR	NOT SEPARATELY REPLACEABLE	S-B	SLOW-BLOW
BD	BOARD(S)	HP	HEWLETT-PACKARD			SCR	SILICON CONTROLLED RECTIFIER
BH	BINDER HEAD	HZ	HERTZ			SE	SELENIUM
BP	BANDPASS	IF	INTERMEDIATE FREQ.	OBD	ORDER BY DESCRIPTION	SEC	SECOND(S)
C	CENTI (10^{-2})	IMPG	IMPREGNATED	OH	OVAL HEAD	SECT	SECTION(S)
CAR	CARBON	INCD	INCANDESCENT	OX	OXIDE	SI	SILICON
CCW	COUNTERCLOCKWISE	INCL	INCLUDE(S)			SIL	SILVER
CER	CERAMIC	INS	INSULATION(ED)	P	PEAK	SL	SLIDE
CMO	CABINET MOUNT ONLY	INT	INTERNAL	PC	PRINTED (ETCHED) CIRCUIT(S)	SP	SINGLE POLE
COAX	COAXIAL	K	KILO (10^{3})	PF	PICOFARADS	SPL	SPECIAL
COEF	COEFFICIENT	KG	KILOGRAM	PHL	PHILLIPS	ST	SINGLE THROW
COMP	COMPOSITION	LB	POUND(S)	PIV	PEAK INVERSE VOLTAGE(S)	STD	STANDARD
CONN	CONNECTOR(S)	LH	LEFT HAND	PNP	POSITIVE-NEGATIVE-POSITIVE	TA	TANTALUM
CRT	CATHODE-RAY TUBE	LIN	LINEAR TAPER	P/O	PART OF	TD	TIME DELAY
CW	CLOCKWISE	LOG	LOGARITHMIC TAPER	PORC	PORCELAIN	TFL	TEFLON
D	DECI (10^{-1})	LPF	LOW-PASS FILTER(S)	POS	POSITION(S)	TGL	TOGGLE
DEPC	DEPOSITED CARBON	LVR	LEVER	POT	POTENTIOMETER(S)	THYR	THYRISTOR
DP	DOUBLE POLE	M	MILLI (10^{-3})	P-P	PEAK-TO-PEAK	TI	TITANIUM
DT	DOUBLE THROW	MEG	MEGA (10^{6})	PRGM	PROGRAM	TNLDIO	TUNNEL DIODE(S)
ELECT	ELECTROLYTIC	MET FILM	METAL FILM	PS	POLYSTYRENE	TOL	TOLERANCE
ENCAP	ENCAPSULATED	MET OX	METAL OXIDE	PWV	PEAK WORKING VOLTAGE	TRIM	TRIMMER
EXT	EXTERNAL	MFR	MANUFACTURER			U	MICRO (10^{-6})
F	FARAD(S)	MINAT	MINIATURE	RECT	RECTIFIER(S)	V	VOLTS
FET	FIELD-EFFECT TRANSISTOR(S)	MOM	MOMENTARY	RF	RADIO FREQUENCY	VAR	VARIABLE
FH	FLAT HEAD	MTG	MOUNTING	RFI	RADIO FREQUENCY INTERFERENCE	VDCW	DC WORKING VOLT(S)
FIL H	FILLISTER HEAD	MY	MYLAR	RH	ROUND HEAD OR RIGHT HAND	W	WATT(S)
FXD	FIXED	N	NANO (10^{-9})	RMO	RACK MOUNT ONLY	W/	WITH
G	GIGA (10^{9})	N/C	NORMALLY CLOSED	RMS	ROOT MEAN SQUARE	WIV	WORKING INVERSE VOLTAGE
GE	GERMANIUM	NE	NEON			W/O	WITHOUT
GL	GLASS	N/O	NORMALLY OPEN			WW	WIREWOUND
GRD	GROUNDED	NOP	NEGATIVE POSITIVE ZERO (ZERO TEMPERATURE COEFFICIENT)				

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			CHASSIS PARTS		
A1	01825-66512		ASSY:MAIN	28480	01825-66512
A2	01825-66502		ASSY:MODE	28480	01825-66502
A3	01825-66503		ASSY:DISPLAY SWITCH	28480	01825-66503
A4	01825-66511		ASSY:DELAYED SWITCH	28480	01825-66511
A5	01825-66505		ASSY:DELAYED SWEEP COMPONENTS	28480	01825-66505
A6	01824-66506		ASSY:VERTICAL CONNECTOR	28480	01824-66506
A7	01825-66507		ASSY:MAIN SWEEP COMPONENTS 1	28480	01825-66507
A8	01825-66508		ASSY:MAIN SWITCH	28480	01825-66508
A9	01825-66509		ASSY:MAIN SWEEP COMPONENTS 2	28480	01825-66509
A10	01824-66507		ASSY:MAINFRAME CONNECTOR	28480	01824-66507
DS1	2140-0053	1	LAMP:INCANDESCENT 10.0V 0.014A	08806	1689D
DS	2140-0008	1	LAMP:GLOW 0.3 MILLIAMPS 0.04W	08806	A1A (NE-2)
J1	1250-0118	2	CONNECTOR:BNC	24931	28JR 128-1
J2	1250-0118		CONNECTOR:BNC	24931	28JR 128-1
J3	1250-0898	1	CONNECTOR:RF 75 OHM SUB-MINIAT	98291	52-146-0000
MP1	0370-0348	1	KNOB:RND BLK 0.540" DIA	28480	0370-0348
MP2	01821-67401	1	KNOB WITH ARROWS +/0/-	28480	01821-67401
MP3	01825-67401	1	KNOB:VERNIER	28480	01825-67401
MP4	01841-27401	1	KNOB:DELAYED TIME/DIV	28480	01841-27401
MP5	01841-67401	2	KNOB ASSY:MAIN TIME/DIV	28480	01841-67401
MP6	01841-67403	1	KNOB ASSY:DELAYED LEVEL	28480	01841-67403
MP7	1140-0057		DIAL:TURNS COUNTING	73138	MODEL 2606
MP8	01821-01205	2	BRACKET:SWEEP DIAL	28480	01821-01205
MP9	01825-04001	1	DIAL:SWEEP	28480	01825-04001
MP10	0370-0451	11	BEZEL:PUSHBUTTON KNOB BLK NYLON	28480	0370-0451
MP11	0370-0938	7	BEZEL, PUSHBUTTON KNOB:GRAY	28480	0370-0938
MP12	01841-67401		KNOB ASSY:MAIN TIME/DIV	28480	01841-67401
MP13	01825-23901	4	SHAFT:REJECT SWITCHES	28480	01825-23901
MP14	01830-23201	4	COUPLER:BAL SHAFT	28480	01830-23201
MP15	01841-23701	2	SHAFT:DELAYED/MAIN SWEEP	28480	01841-23701
MP16	01841-23701		SHAFT:DELAYED/MAIN SWEEP	28480	01841-23701
MP17	01841-63701	1	SHAFT ASSY:MODE	28480	01841-63701
MP18	1490-0968	1	BUSHING:POTENTIOMETER 1/4-32 EXT THRD	00000	OBD
MP19	01821-01205		BRACKET:SWEEP DIAL	28480	01821-01205
MP20	00183-67406	11	PUSHBUTTON ASSY:BLACK FRONT	28480	00183-67406
MP21	01841-67404	7	PUSHBUTTON ASSY:GRAY FRONT	28480	01841-67404
MP22	3130-0339	2	ROTOR ASSY:MALE	28480	3130-0339
MP23	3130-0339		ROTOR ASSY:MALE	28480	3130-0339
MP24	3130-0401	1	ROTOR ASSY:FEMALE	28480	3130-0401
MP25	3130-0340	1	ROTOR ASSY:FEMALE	28480	3130-0340
MP26	0510-1101	2	SPRING:RETAINER(PC SWITCH)	28480	0510-1101
MP27	0510-1101		SPRING:RETAINER(PC SWITCH)	28480	0510-1101
MP28	01821-04101	1	BRACKET:PLUG	28480	01821-04101
MP29	01821-43101	1	GUIDE:LATCH	28480	01821-43101
MP30	01824-00203	1	PANEL:REAR	28480	01824-00203
MP31	01824-61201	1	BRACKET ASSY	28480	01824-61201
MP32	01825-00201	1	PANEL:FRONT	28480	01825-00201
MP33	01825-00203	1	PANEL:SUB	28480	01825-00203
MP34	01825-01201	1	BRACKET:RIGHT	28480	01825-01201
MP35	01841-01202	1	BRACKET:LEFT	28480	01841-01202
MP36	01841-01205	1	BRACKET:TOP	28480	01841-01205
R1	2100-2635	1	R:VAR COMP 50K OHM 20% LIN 1/2W	28480	2100-2635
R2	2100-3220	2	R:VAR COMP 15K OHM 10% 1/2W	28480	2100-3220
R3	2100-3220		R:VAR COMP 15K OHM 10% 1/2W	28480	2100-3220
R4	0687-8221	1	R:FXD COMP 8200 OHM 10% 1/2W	01121	EB 8221
R5	2100-3233	1			
R6	2100-2063	1	R:VAR COMP 1K OHM 10% LIN 1/2W	28480	2100-2063
R7	2100-1443	1	R:VAR WW 50K OHM 3% 2W	28480	2100-1443
R8	0687-3931	1	R:FXD COMP 39K OHM 10% 1/2W	01121	EB 3931
S1			S:NSR P/O R5		
S2			S:NSR P/O R3		
W1	01825-61616	1	CABLE ASSY:A3 TO FRONT PANEL	28480	01825-61616
W2	01825-61611	1	CABLE ASSY:RIBBON A1 TO A3	28480	01825-61611
W3	01825-61604	1	CABLE:COAX REAR PANEL MAIN GATE	28480	01825-61604
W4			NOT ASSIGNED		
W5	01825-61606	1	CABLE:COAX REAR PANEL DELAYED RAMP	28480	01825-61606
W6	01825-61610	1	CABLE:COAX DELAYED RAMP TO DISPLAY SW.	28480	01825-61610
W7	01825-61609	1	CABLE:COAX DELAYED RESET REFERENCE	28480	01825-61609
W8	01824-61610	1	CABLE ASSY	28480	01824-61610
W9	01825-61602	1	CABLE:COAX GATE OUT	28480	01825-61602
W10	01825-61601	1	CABLE:COAX RAMP OUT	28480	01825-61601
W11	01841-61620	1	CABLE:FLEX	28480	01841-61620
W12	01825-61613	1	CABLE:COAX DELAY POT	28480	01825-61613
W13	01825-61607	1	CABLE:COAX LINE SYNC	28480	01825-61607
W14	01825-61608	1	CABLE:COAX COAX MAIN RAMP TO DISPLAY SW	2848	001825-61608
W15	01824-61611	1	CABLE:POWER	28480	01824-61611
W16	01825-61617	1	CABLE: MAIN (INCLUDES W3, W5, W7, W8, W12, W14, W15	28480	01825-61617

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	01825-66512	1	ASSY:MAIN	28480	01825-66512
A1C1	C150-0024	2	C:FXD CER 0.02 UF +80-20% 600VDCW	71590	TYPE DD 203
A1C2	0160-3446	2	C:FXD CER 220 PF 10% 1KVDCW	56289	C016B102F221KS25-CDH
A1C3	0160-0155	1	C:FXD MY 0.0033 UF 10% 200VDCW	56289	192P33292-PTS
A1C4	0180-0291	2	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A1C5	0180-0197	10	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1C6	0160-0168	4	C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A1C7	0160-3446		C:FXD CER 220 PF 10% 1KVDCW	56289	C016B102F221KS25-CDH
A1C8	0150-0024		C:FXD CER 0.02 UF +80-20% 600VDCW	71590	TYPE DD 203
A1C9	0160-0300	1	C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A1C10	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A1C11	0160-3470	1	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C12	0160-3466	2	C:FXD CER 100 PF 10% 250VDCW	56289	C157F251F101KS22-CDH
A1C13	0160-3466		C:FXD CER 100 PF 10% 250VDCW	56289	C157F251F101KS22-CDH
A1C14	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1C15	0160-2257	3	C:FXD CER 10 PF 5% 500VDCW	72982	301-000-COH0-100J
A1C16	0160-3451	34	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C17	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C18	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C19	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C20	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C21	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C22	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C23	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C24	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C25	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C26					
A1C27					
A1C28	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C29	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1C30	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C31	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C32	0180-0197		C:FXD ELECT 2.2 UF 10% 20 VDCW	56289	150D225X9020A2-DYS
A1C33					
A1C34	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C35	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1C36	0160-3470	1	C:FXD CER 0.01 UF +80 -20% 50 VDCW	72982	8121-050-651-103Z
A1C37	0160-2240		C: FXD CER 2.0 PF 500 VDCW	72982	301-000-C0K0-209C
A1C38	0160-2201	2	C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A1C39	0160-2201		C:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A1C40	0160-3451		C:FXD CER 0.01 UF +80 -20% 100 VDCW	56289	C023B101F103ZS25-CD
A1C42	0160-2150	24	C: FXD MICA 33 PF 590	28480	0160-2150
A1CR1	1901-0047	1	DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A1CR2	1901-0047		DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A1CR3	1901-0047		DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A1CR4	1901-0040	25	DIODE:SILICON 30 MA 30 WV	07263	FDG 1088
A1CR5	1910-0016	1	DIODE: GERMANIUM 100 MA/0.85V 60 PIV	93332	02361
A1CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR7			NOT ASSIGNED		
A1CR8	1901-0047		DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A1CR9	1901-0047		DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A1CR10	1901-0047		DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A1CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR12	1901-0047		DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A1CR13	1901-0047		DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A1J1	1251-0477	3	CONNECTOR:PC 12 FORK TYPE CONTACT	95354	91-6912-1700-00
A1J2	1200-0441	4	SOCKET:IC 14 PIN MINIATURE	28480	1200-0441
A1J3	1251-0477		CONNECTOR:PC 12 FORK TYPE CONTACT	95354	91-6912-1700-00
A1J4	1251-0477		CONNECTOR:PC 12 FORK TYPE CONTACT	95354	91-6912-1700-00
A1J5	1200-0441	3	SOCKET:IC 14 PIN MINIATURE	28480	1200-0441
A1L1	9100-2247	4	COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A1L2	9100-2247		COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A1L3	9100-2247		COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A1L4	9100-2247		COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A1L5	9140-0115	4	COIL:FXD RF 22 UH 10%	99800	2150-32
A1L6	9140-0115		COIL:FXD RF 22 UH 10%	99800	2150-32
A1L7	9170-0029	4	CORE:FERRITE BEAD	02114	56-590-65/3B
A1L8	9170-0029		CORE:FERRITE BEAD	02114	56-590-65/3B
A1Q1	1855-0081	2	TSTR:SI FET	80131	2N5245
A1Q2	1853-0203	2	TSTR:SI PNP	28480	1853-0203
A1Q3	1854-0092	10	TSTR:SI NPN	80131	2N3563
A1Q4	1854-0092		TSTR:SI NPN	80131	2N3563
A1Q5	1854-0092		TSTR:SI NPN	80131	2N3563
A1Q6	1854-0092		TSTR:SI NPN	80131	2N3563
A1Q7	1854-0071	20	TSTR:SI NPN	28480	1854-0071
A1Q8	1853-0086	13	TSTR:SI PNP	80131	2N5087
A1Q9	1853-0086		TSTR:SI PNP	80131	2N5087
A1Q10	1853-0086		TSTR:SI PNP	80131	2N5087
A1Q11	1855-0081		TSTR:SI FET	80131	2N5245
A1Q12	1853-0203		TSTR:SI PNP	28480	1853-0203
A1Q13	1854-0092		TSTR:SI NPN	80131	2N3563
A1Q14	1854-0092		TSTR:SI NPN	80131	2N3563
A1Q15	1854-0092		TSTR:SI NPN	80131	2N3563
A1Q16	1854-0092		TSTR:SI NPN	80131	2N3563
A1Q17	1853-0086		TSTR:SI PNP	80131	2N5087
A1Q18	1853-0086		TSTR:SI PNP	80131	2N5087
A1Q19	1854-0215	19	TSTR:SI NPN	80131	2N3904
A1Q20	1854-0215		TSTR:SI NPN	80131	2N3904

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1Q21	1854-0215		TSTR:SI NPN	80131	2N3904
A1Q22	1854-0215		TSTR:SI NPN	80131	2N3904
A1Q23	1854-0215		TSTR:SI NPN	80131	2N3904
A1Q24	1854-0215		TSTR:SI NPN	80131	2N3904
A1Q25	1854-0215		TSTR:SI NPN	80131	2N3904
A1R1	0684-2201	7	R:FXD COMP 22 OHM 10% 1/4W	01121	CB 2201
A1R2	0757-0488	4	R:FXD MET FLM 909K OHM 1% 1/8W	28480	0757-0488
A1R3	0757-0465	3	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A1R4	0684-1061	3	R:FXD COMP 10 MEGOHM 10% 1/4W	01121	CB 1061
A1R5	0683-1055	2	R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A1R6	0684-1031	5	R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A1R7	0757-0488		R:FXD MET FLM 909K OHM 1% 1/8W	28480	0757-0488
A1R8	0757-0471	2	R:FXD MET FLM 182K OHM 1% 1/8W	28480	0757-0471
A1R9	0684-5601	2	R:FXD COMP 56 OHM 10% 1/4W	01121	CB 5601
A1R10	0684-3321	2	R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A1R11	0698-3159	1	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A1R12	0757-0290	3	R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A1R13	0698-3153	2	R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A1R14	0757-0280	9	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R15	0757-0283	11	R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A1R16	0757-0419	2	R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A1R17	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A1R18	0675-1011	10	R:FXD COMP 100 OHM 10% 1/8W	01121	BB-1011
A1R19	0675-1011		R:FXD COMP 100 OHM 10% 1/8W	01121	BB-1011
A1R20	0698-3430	4	R:FXD MET FLM 21.5 OHM 1% 1/8W	28480	0698-3430
A1R21	0698-7212		R:FXD FLM 100 OHM 2% 1/8W	28480	0698-7212
A1R22	0684-5611	2	R:FXD COMP 560 OHM 10% 1/4W	01121	CB 5611
A1R23	0684-2201	2	R:FXD COMP 22 OHM 10% 1/4W	01121	CB 2201
A1R24	0757-0124	4	R:FXD MET FLM 39.2K OHM 1% 1/8W	28480	0757-0124
A1R25	2100-3175	2	R:VAR CERMET 100K OHM 10% LIN 1/2W	28480	2100-3175
A1R26	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R27	0757-0273	4	R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A1R28	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R29	0757-0420	4	R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A1R30	0675-1011		R:FXD COMP 100 OHM 10% 1/8W	01121	BB-1011
A1R31	0675-1011		R:FXD COMP 100 OHM 10% 1/8W	01121	BB-1011
A1R32	0698-3430		R:FXD MET FLM 21.5 OHM 1% 1/8W	28480	0698-3430
A1R33	0757-0124		R:FXD MET FLM 39.2K OHM 1% 1/8W	28480	0757-0124
A1R34	0684-2201		R:FXD COMP 22 OHM 10% 1/4W	01121	CB 2201
A1R35	0757-0398	4	R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A1R36	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A1R37	0757-0398		R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A1R38	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A1R39	0684-4711	1	R: FXD COMP 470 OHM 10% 1/4W	01121	CB 4711
A1R40	0757-0487	3	R:FXD MET FLM 825K OHM 1% 1/8W	28480	0757-0487
A1R41	0757-0415	4	R:FXD MET FLM 475 OHM 1% 1/8W	28480	0757-0415
A1R42	0698-8139	2	R:FXD MET OX 10K OHM 2.0% 1.0W	28480	0698-8139
A1R43	0757-0412	2	R:FXD MET FLM 365 OHM 1% 1/8W	28480	0757-0412
A1R44	0757-0427	2	R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R45	0757-0199	2	R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A1R46	0757-0438	6	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1R47	0757-0416	4	R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A1R48	0683-1055		R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A1R49	0757-0488		R:FXD MET FLM 909K OHM 1% 1/8W	28480	0757-0488
A1R50	0757-0471		R:FXD MET FLM 182K OHM 1% 1/8W	28480	0757-0471
A1R51	0684-2201		R:FXD COMP 22 OHM 10% 1/4W	01121	CB 2201
A1R52	0757-0488		R:FXD MET FLM 909K OHM 1% 1/8W	28480	0757-0488
A1R53	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A1R54	0684-5601		R:FXD COMP 56 OHM 10% 1/4W	01121	CB 5601
A1R55	0684-1061		R:FXD COMP 10 MEGOHM 10% 1/4W	01121	CB 1061
A1R56	0684-3321		R:FXD COMP 3300 OHM 10% 1/4W	01121	CB 3321
A1R57	0757-0290		R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A1R58	0698-3153		R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A1R59	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R60	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A1R61	0757-0419		R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A1R62	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A1R63	0675-1011		R:FXD COMP 100 OHM 10% 1/8W	01121	BB-1011
A1R64	0675-1011		R:FXD COMP 100 OHM 10% 1/8W	01121	BB-1011
A1R65	0698-3430		R:FXD MET FLM 21.5 OHM 1% 1/8W	28480	0698-3430
A1R66	0684-2201		R:FXD COMP 22 OHM 10% 1/4W	01121	CB 2201
A1R67	0757-0124		R:FXD MET FLM 39.2K OHM 1% 1/8W	28480	0757-0124
A1R68	2100-3175		R:VAR CERMET 100K OHM 10% LIN 1/2W	28480	2100-3175
A1R69	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R70	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R71	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R72	0757-0420		R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A1R73	C675-1011		R:FXD COMP 100 OHM 10% 1/8W	01121	BB-1011
A1R74	0675-1011		R:FXD COMP 100 OHM 10% 1/8W	01121	BB-1011
A1R75	0684-5611		R:FXD COMP 560 OHM 10% 1/4W	01121	CB 5611
A1R76	0698-3430		R:FXD MET FLM 21.5 OHM 1% 1/8W	28480	0698-3430
A1R77	0757-0124		R:FXD MET FLM 39.2K OHM 1% 1/8W	28480	0757-0124
A1R78	0684-2201		R:FXD COMP 22 OHM 10% 1/4W	01121	CB 2201
A1R79	0757-0410	1	R:FXD MET FLM 301 OHM 1% 1/8W	28480	0757-0410
A1R80	0757-0424	1	R:FXD MET FLM 1.10K OHM 1% 1/8W	28480	0757-0424
A1R81	0757-0398		R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A1R82	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A1R83	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A1R84	0757-0398		R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A1R85	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A1R86	0757-0415		R:FXD MET FLM 475 OHM 1% 1/8W	28480	0757-0415
A1R87	0698-8139		R:FXD MET OX 10K OHM 2.0% 1.0W	28490	0698-8139
A1R88	0757-0412		R:FXD MET FLM 365 OHM 1% 1/8W	28480	0757-0412
A1R89	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A1R90	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R91	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1R92	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A1R93	0684-1011	38	R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R94	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R95	0684-1521	2	R:FXD COMP 1500 OHM 10% 1/4W	01121	CB 1521
A1R96	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R97	0757-0437	3	R:FXD MET FLM 4750 OHM 1% 1/8W	28480	0757-0437
A1R98	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A1R99	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R100	0757-0281	1	R:FXD MET FLM 2.74K OHM 1% 1/8W	28480	0757-0281
A1R101	0764-0044	1	R:FXD MET OX 8.2K OHM 5% 2W	28480	0764-0044
A1R102	C757-0408	2	R:FXD MET FLM 243 OHM 1% 1/8W	28480	0757-0408
A1R103	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R104	0698-3150	1	R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R105	0757-0422	3	R:FXD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A1R106	0757-0440	1	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A1R107	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R108	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R109	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R110	0684-1521		R:FXD COMP 1500 OHM 10% 1/4W	01121	CB 1521
A1R111	0684-2721	3	R:FXD COMP 2700 OHM 10% 1/4W	01121	CB 2721
A1R112	0683-5115		R: FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A1R113	0757-0288	2	R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A1R114	0757-0273		R:FXD MET FLM 3.01K OHM 1% 1/8W	28480	0757-0273
A1R115	0757-0417	3	R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A1R116	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R117	0684-5601		R: FXD COMP 56 OHM 10% 1/4W	01121	CB 5601
A1R118	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R119	0684-5601		R: FXD COMP 56 OHM 10% 1/4W	01121	CB 5601
A1R120	0757-0417		R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A1R121	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R122					
A1R123	0684-3901	4	R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A1R124	0684-0271	2	R:FXD COMP 2.7 OHM 10% 1/4W	01121	CB 27G1
A1R125	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R126	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R127	0684-0271		R:FXD COMP 2.7 OHM 10% 1/4W	01121	CB 27G1
A1R128					
A1R129	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R130	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A1R131	0698-3159		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3159
A1R132	0698-7212		R:FXD FLM 100 OHM 2% 1/8W	28480	0698-7212
A1S1	3101-1662	3	SWITCH:PUSHBUTTON 2 STATION EA. DPDT	28480	3101-1662
A1S2	3101-1665		SWITCH:PUSHBUTTON 2 STATION EA. DPDT	28480	3101-1662
A1S3	3101-1662	1	SWITCH:PUSHBUTTON 4 STATION EA. DPDT	28480	3101-1665
A1S4	3101-1663	1	SWITCH:PUSHBUTTON 2 STATION EA. DPDT	71590	PB-10
A1S5	3101-1664		SWITCH:PUSH BUTTON SINGLE STATION DPDT	71590	PB-1
A1U1	1858-0004	2	TSTR ARRAY:SI NPN DUAL DIFF. AMPL.	28480	1858-0004
A1U2	1820-0806	2	IC	28480	1820-0806
A1U3	1858-0004		TSTR ARRAY:SI NPN DUAL DIFF. AMPL.	28480	1858-0004
A1U4	1820-0142	1	INTEGRATED CIRCUIT:4 INPUT 2-DR/NOR	04713	MC 1004P
A1U5	1820-0806		IC	28480	1820-0806
A1VR1	1902-3002	2	DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A1VR2	1902-0041	3	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1VR3	1902-3086	2	DIODE BREAKDOWN:4.75 V 2%	28480	1902-3086
A1VR4	1902-3002		DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A1VR5	1902-3086		DIODE:BREAKDOWN 4.75V 2%	28480	01902-3086
A1VR6	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A2	01825-66502	1	ASSY:MODE	28480	01825-66502
A2C1	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2C2			C:FXD CER 0.01 UF +80-20% 100VDCW		
A2C3	0150-0059	1	C:FXD CER 3.3-0.25 PF 500VDCW	72982	301-000-COJ0-339C
A2C4	0160-3451		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	C023B101F103ZS25-CDH
A2C5	0160-2247	1	C:FXD CER 3.9 PF 500VDCW	72982	301-NP0-3.9 PF
A2C6	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A2C7	0160-0134	1	C:FXD MICA 220PF 5% 300VDCW	14655	RDM15F221J3C
A2C8	0160-2257		C:FXD CER 10 PF 5% 500VDCW	72982	301-000-C0H0-100J
A2C9	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A2C10	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A2C11	0160-3451		C:FXD CER 0.01 UF +80 -20% 100 VDCW	56289	C023B101F103ZS25-CD
A2J1	1251-3071	1	8 FEMALE RECEPTACLE	28480	1251-3071
A2P1	1200-0441		SOCKET:IC 14 PIN MINIATURE	28480	1200-0441
A2Q1	1854-0215		TSTR:SI NPN	80131	2N3904
A2Q2	1854-0215		TSTR:SI NPN	80131	2N3904
A2Q3	1854-0092		TSTR:SI NPN	80131	2N3563
A2Q4	1853-0015	1	TSTR:SI PNP	80131	2N3640
A2R1	0757-0437		R:FXD MET FLM 4750 OHM 1% 1/8W	28480	0757-0437
A2R2	0757-0422		R:FXD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A2R3	0757-0415		R:FXD MET FLM 475 OHM 1% 1/8W	28480	0757-0415
A2R4			NOT ASSIGNED		
A2R5	0757-0487		R:FXD MET FLM 825K OHM 1% 1/8W	28480	0757-0487
A2R6	0684-4721	4	R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A2R7	0698-8198	2	R:FXD MET FLM 1.58M OHM 1% 1/8W	28480	0698-8198
A2R8	0757-0473	2	R:FXD MET FLM 221K OHM 1% 1/8W	28480	0757-0473
A2R9	0683-1555	2	R:FXD COMP 1.5 MEGOHM 5% 1/4W	01121	CB 1555
A2R10			NOT ASSIGNED		
A2R11	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A2R12	0757-0278	1	R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A2R13	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A2R14	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	C B 1031
A2R15	0698-8198		R:FXD MET FLM 1.58M OHM 1% 1/8W	28480	0698-8198
A2R16	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A2R17	0757-0473		R:FXD MET FLM 221K OHM 1% 1/8W	28480	0757-0473
A2R18	0757-0487		R:FXD MET FLM 825K OHM 1% 1/8W	28480	0757-0487
A2R19	0683-1555		R:FXD COMP 1.5 MEGOHM 5% 1/4W	01121	CB 1555
A2R20	0757-0437		R:FXD MET FLM 4750 OHM 1% 1/8W	28480	0757-0437
A2R21	0757-0415		R:FXD MET FLM 475 OHM 1% 1/8W	28480	0757-0415
A2R22	0757-0422		R:FXD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A2R23	0757-0402	1	R:FXD MET FLM 110 OHM 1% 1/8W	28480	0757-0402
A2R24	0757-0420		R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A2R25	0675-1011		R:FXD COMP 100 OHM 10% 1/8W	01121	B8-1011
A2R26	0757-0408		R:FXD MET FLM 243 OHM 1% 1/8W	28480	0757-0408
A2R27	0757-0446	1	R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A2R28	0687-4711	1	R:FXD COMP 470 OHM 10% 1/2W	01121	EB 4711
A2R29	0687-2221	1	R:FXD COMP 2200 OHM 10% 1/2W	01121	EB 2221
A2R30	0684-6801	1	R:FXD COMP 68 OHM 10% 1/4W	01121	CB 6801
A2R31	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A2R32	0684-1211	1	R:FXD COMP 120 OHM 10% 1/4W	01121	CB 1211
A2R33	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A2R34	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A2R35	0684-6801		R:FXD COMP 68 OHM 10% 1/4W	01121	CB 6801
A2S1	3101-0535	2	SWITCH:PUSHBUTTON 2P SINGLE STATION	28480	3101-0535
A2S2	3101-1516	1	SWITCH:PUSHBUTTON 3 SECTION	28480	3101-1516
A2S3	3101-0535		SWITCH:PUSHBUTTON 2P SINGLE STATION	28480	3101-0535
A2U1	1826-0086	2	IC:LINEAR OP. AMPL.	07263	U587776393
A2U2	1826-0086		IC:LINEAR OP. AMPL.	07263	U587776393
A2VR1	1902-3059	1	DIODE BREAKDOWN:SILICON 3.83V 5%	28480	1902-3059
A2VR2	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A3	01825-66503	1	ASSY:DISPLAY SWITCH	28480	01825-66503
A3R1	2100-3123	1	R:VAR CERMET 500 OHM 10% TYPE P 3/4W	28480	2100-3123
A3S1	3101-1666	1	SWITCH:PUSHBUTTON 2 STATION EA. 6PDT	28480	3101-1666
A4	01825-66511	1	ASSY:DELAYED SWITCH	28480	01825-66511
A4C1	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A4C2	0160-3987	2	C:FXD MICA 82 PF 5%	28480	0160-3987
A4C3	0121-0456	2	C:VAR AIR 1.9-15.7 PF	74970	187-109-105
A4C4	0160-2431	2	C:FXD POLY 0.01 UF 5% 100VDCW	84411	863T
A4C5	0160-3324	2	C:FXD MET POLY 1.0 UF 5% 100VDCW	84411	HEW-249
A4CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A4L1	9170-0029		CORE:FERRITE BEAD	02114	56-590-65/3B
A4Q1	1853-0036	2	TSTR:SI PNP	80131	2N3906
A4R1	0684-2211	4	R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A4R2	2100-3161	5	R:VAR CERMET 20K OHM 10% TYPE P 3/4W	28480	2100-3161
A4R3	0757-0060	1	R:FXD MET FLM 24.3K OHM 1% 1/2W	28480	0757-0060
A4R4	2100-3161		R:VAR CERMET 20K OHM 10% TYPE P 3/4W	28480	2100-3161
A4R5	0757-0442	5	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A4R6	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R7	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A4R8	0698-8149	2	R:FXD FLM 40K OHM 0.1% 1/4W	28480	0698-8149
A4R9	0698-8147	2	R:FXD FLM 80K OHM 0.1% 1/8W	28480	0698-8147
A4R10	0698-8146	2	R:FXD FLM 160K OHM 0.1% 1/8W	28480	0698-8146
A4R11	0698-5171	2	R:FXD FLM 400K OHM 0.1% 1/8W	28480	0698-5171
A4R12	0698-8159	2	R:FXD FLM 800K OHM 0.1% 1/4W	28480	0698-8159
A4R13	0698-8141	2	R:FXD MET FLM 1.6 MEGOHM 0.1% 1/2W	28480	0698-8141
A4R14	0687-1801	1	R:FXD COMP 18 OHM 10% 1/2W	01121	EB 1801
A4R15	0686-3935		R: FXD COMP 39K OHM 5% 1/2W	01121	EB 3935
A4S1			CONSISTS OF MP22, MP24, MP26 AND PLATED CONTACTS ON A4.		
A5	01825-66505	1	ASSY:DELAYED SWEEP COMPONENTS	28480	01825-66505
A5C1			NOT ASSIGNED		
A5C2	0160-2261	2	C:FXD CER 15 PF 5% 500VDCW	72982	301-NPO-15 PF
A5C3	0160-2204	1	C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A5C4	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A5C5	0150-0115	1	C:FXD CER 27 PF 10% 500VDCW	72982	301-000-U2J0-270K
A5C6	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A5C7	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A5C8	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A5C9	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A5C10	0160-3451		C:FXD CER 0.01 UF +80 -20% 100VDCW	56289	C023B101F103ZS25-CDH
A5C11	0160-3451		C:FXD CER 0.01 UF +80 -20% 100VDCW	56289	C023B101F103ZS25-CDH
A5C12	0160-3451		C: FXD CER 0.01 UF +80-20% 100 VDCW	56289	C023B101F103ZS25-CDH
A5CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR7	1901-0040		DIODE: SILICON 30 MA 30 WV	07263	FDG 1088
A5Q1	1854-0215		TSTR:SI NPN	80131	2N3904
A5Q2	1854-0215		TSTR:SI NPN	80131	2N3904
A5Q3	1854-0215		TSTR:SI NPN	80131	2N3904
A5Q4	1853-0086	1	TSTR: SI PNP	80131	2N5087
A5Q5	1854-0215		TSTR:SI NPN	80131	2N3904
A5Q6	1853-0086		TSTR:SI PNP	80131	2N5087
A5Q7	1853-0086		TSTR:SI PNP	80131	2N5087
A5Q8	1854-0548	4	TSTR:SI NPN	80131	2N5963
A5Q9	1854-0548		TSTR:SI NPN	80131	2N5963
A5Q10	1853-0244	2	TSTR:SI PNP	28480	1853-0244
A5Q11	1853-0086		TSTR:SI PNP	80131	2N5087
A5R1	0757-0850	1	R:FXD MET FLM 39.2K OHM 1.0% 1/2W	28480	0757-0850
A5R2	0684-1021	3	R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A5R3	0757-0288		R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A5R4	0757-0466	1	R:FXD MET FLM 110K OHM 1% 1/8W	28480	0757-0466
A5R5	0757-0846	1	R:FXD MET FLM 22.1K OHM 1.0% 1/2W	28480	0757-0846
A5R6	0684-4721		R:FXD COMP 4700 OHM 10% 1/4W	01121	CB 4721
A5R7	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5R8	0684-2211		R:FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A5R9			NOT ASSIGNED		
A5R10	0757-0847	1	R:FXD MET FLM 27.4K OHM 1% 1/2W	28480	0757-0847
A5R11	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5R12	0684-1031		R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031
A5R13	0757-0283	4	R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A5R14	0757-0420		R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A5R15	0761-0074	2	R:FXD MET OX 15K OHM 5% 1W	28480	0761-0074
A5R16	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5R17	0684-2201		R:FXD COMP 22 OHM 10% 1/4W	01121	CB 2201
A5R18	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A5R19	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A5R20	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5R21	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5R22	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5R23	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5R24	0684-1001	3	R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A5R25	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5R26	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A5R27	0757-0404	1	R:FXD FLM 130 OHM 1% 1/8W	28480	0757-0404
A6	01824-66506		ASSY:VERTICAL CONNECTOR	28480	01824-66506
A6C1	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6C2	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A6J1	1251-0054	1	CONNECTOR:FEMALE 24-CONTACT	28480	1251-0054
A6J2	1200-0441	2	SOCKET:IC 14 PIN MINIATURE	28480	1200-0441
A6L1	9140-0115		COIL:FXD RF 22 UH 10%	99800	2150-32
A6L2	9140-0115		COIL:FXD RF 22 UH 10%	99800	2150-32
A7	01825-66507	2	ASSY:MAIN SWEEP COMPONENTS 1	28480	01825-66507
A7C1	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A7C2	0160-2261		C:FXD CER 15 PF 5% 500VDCW	72982	301-NPO-15 PF
A7C3	0160-2150	1	C:FXD MICA 33 PF 5%	28480	0160-2150

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7C4	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A7C5	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A7C6	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A7C7	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A7C8	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A7C9	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A7C10	0160-3354		C:FXD POLY 10 UF +5 -15% 100VDCW	84411	HEW 247
A7CR1 thru A7CR4	1901-0040		DIODE: SILICON 30 MA 30 WV	07263	FDG 1088
A7J1	1251-3272	1	CONNECTOR: 6 PIN		1251-3272
A7Q1	1853-0086		TSTR:SI PNP	80131	2N5087
A7Q2	1854-0092		TSTR:SI NPN	80131	2N3563
A7Q3	1854-0215		TSTR:SI NPN	80131	2N3904
A7Q4	1854-0215		TSTR:SI NPN	80131	2N3904
A7Q5	1854-0215		TSTR:SI NPN	80131	2N3904
A7Q6	1854-0215		TSTR:SI NPN	80131	2N3904
A7Q7	1853-0086		TSTR:SI PNP	80131	2N5087
A7Q8	1854-0215		TSTR:SI NPN	80131	2N3904
A7Q9	1853-0086		TSTR:SI PNP	80131	2N5087
A7R1	0684-3311	1	R:FXD COMP 330 OHM 10% 1/4W	01121	CB 3311
A7R2	0684-2221		R:FXD COMP 2200 OHM 10% 1/4W	01121	CB 2221
A7R3	0687-1031	1	R:FXD COMP 10K OHM 10% 1/2W	01121	EB 1031
A7R4	0687-1231	1	R:FXD COMP 12K OHM 10% 1/2W	01121	EB 1231
A7R5	0684-4731	3	R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A7R6	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A7R7	0684-1041	2	R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A7R8	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A7R9	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A7R10	0757-0279	1	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A7R11	0698-8140	1	R:FXD MET OX 15K OHM 2.0% 1.0W	28480	0698-8140
A7R12	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A7R13	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A7R14	0761-0076	1	R:FXD MET OX 18K OHM 5% 1W	28480	0761-0076
A7R15	0683-1825	1	R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825
A7R16	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A7R17	0757-0476	1	R:FXD MET FLM 301K OHM 1% 1/8W	28480	0757-0476
A7R18	0684-3921	2	R:FXD COMP 3900 OHM 10% 1/4W	01121	CB 3921
A7R19	0684-3921		R:FXD COMP 3900 OHM 10% 1/4W	01121	CB 3921
A7R20	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A7R21	0684-1021		R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021
A7R22	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A7R23	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A7R24	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A7R25	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A7R26	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A8	01825-66508	1	ASSY:MAIN SWEEP COMPONENTS 1	28480	01825-66508
A8C1		2	NOT ASSIGNED		
A8C2			NOT ASSIGNED		
A8C3	0121-0456		C:VAR AIR 1.9-15.7 PF	74970	187-109-105
A8C4	0140-0193		C:FXD MICA 82 PF 5%	28480	0140-0193
A8C5	0160-2020	1	C:FXD MICA 910 PF 5% 100VDCW	00853	RDM15F911J1S
A8C6	0160-2431		C:FXD POLY 0.01 UF 5% 100VDCW	84411	863T
A8C7	0160-3324		C:FXD MET POLY 1.0 UF 5% 100VDCW	84411	HEW-249
A8C8	0140-0207	1	C:FXD MICA 330 PF 5%	28480	0140-0207
A8C9	0160-0157	1	C:FXD MY 0.0047 UF 10% 200VDCW	56289	192P47292-PTS
A8C10	0160-0163	1	C:FXD MY 0.033 UF 10% 200VDCW	56289	192P33392-PTS
A8C11	0180-0195	1	C:FXD ELECT 0.33 UF 20% 35VDCW	56289	150D334X0035A2-DYS
A8C12	0180-0376	1	C:FXD ELECT 0.47 UF 10% 35VDCW	56289	150D474X9035A2-DYS
A8C13	0180-0100	1	C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A8C14	0180-0228	1	C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A8C15	0140-0203		C: FXD MICA 30 PF 5%	28480	0140-0203
A8CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A8CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A8CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A8CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A8CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A8CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A8CR7	1901-0033		DIODE: SILICON 180 WV	07263	FD 3369
A8CR8	1901-0045		DIODE: SILICON 0.75A 100 PIV	04713	SR 1258-7
A8L1	9170-0029		CORE:FERRITE BEAD	02114	56-590-65/3B
A8Q1	1853-0036		TSTR:SI PNP	80131	2N3906
A8R1	2100-3161		R:VAR CERMET 20K OHM 10% TYPE P 3/4W	28480	2100-3161
A8R2	0757-0843	1	R:FXD MET FLM 15.0K OHM 1% 1/2W	28480	0757-0843
A8R3	2100-3161		R:VAR CERMET 20K OHM 10% TYPE P 3/4W	28480	2100-3161
A8R4	2100-3161		R:VAR CERMET 20K OHM 10% TYPE P 3/4W	28480	2100-3161
A8R5	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A8R6	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A8R7	0698-8149		R:FXD FLM 40K OHM 0.1% 1/4W	28480	0698-8149
A8R8	0698-8147		R:FXD FLM 80K OHM 0.1% 1/8W	28480	0698-8147
A8R9	0698-8146		R:FXD FLM 160K OHM 0.1% 1/8W	28480	0698-8146
A8R10	0698-5171		R:FXD FLM 400K OHM 0.1% 1/8W	28480	0698-5171

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8R11	0698-8159		R:FXD FLM 800K OHM 0.1% 1/4W	28480	0698-8159
A8R12	0698-8141		R:FXD MET FLM 1.6 MEGOHM 0.1% 1/2W	28480	0698-8141
A8R13	0698-8142	2	R:FXD MET FLM 4 MEGOHM 0.25% 1/2W	28480	0698-8142
A8R14	0698-8142		R:FXD MET FLM 4 MEGOHM 0.25% 1/2W	28480	0698-8142
A8R15	0687-2231		R:FXD COMP 22K OHM 10% 1/2W	01121	CB 2231
A8R16	2100-3161		R:VAR CERMET 20K OHM 10% TYPE P 3/4W CONSISTS OF MP23, MP25, MP27, AND PLATED CONTACTS ON A8.	28480	2100-3161
A8U1	1820-0203	1	IC:OPERATIONAL AMPLIFIER	07263	SL8940
A8VR1	1901-0782		DIODE: BREAKDOWN 30.1V 1W	28480	1902-0782
A8VR2	1902-3139	2	DIODE:BREAKDOWN 8.25V 5%	04713	SZ10939-158
A9	01825-66509	1	C:FXD CER 15 PF 5% 500VDCW	28480	01825-66509
A9C1	0160-2261		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	301-NPO-15 PF
A9C2	0160-2207	1	C:FXD MICA 300 PF 5%	28480	0160-2207
A9C3	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A9C4	0180-0374	1	C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A9C5	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A9C6	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A9C7	0180-0049		C:FXD ELECT 20 UF +75 -10% 50VDCW	56289	320D206G050CC2-DSM
A9C8	0180-0059	1	C:FXD ELECT 10 UF +75-10% 25VDCW	28480	0180-0059
A9C9	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A9C10	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A9C11	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A9C12	0180-0091	1	C:FXD ELECT 10 UF +50-10% 100VDCW	56289	30D106F100DC2-DSM
A9C13	0180-0197		C: FXD TA 2.2 UF 10% 20 VDCW	56289	150D225X9020AZ-DYS
A9CR1	1906-0042	1	DIODE:DUAL SI, COMMON ANODE	28480	1906-0042
A9CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A9CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A9CR4	1901-0513	1	DIODE:SILICON DUAL 100 WV	04713	SSD 101
A9Q1	1853-0086		TSTR:SI PNP	80131	2N5087
A9Q2	1853-0316	1	TSTR:FET(MATCHED PAIR) N-CHANNEL	28480	1853-0316
A9Q3	1853-0244		TSTR:SI PNP	28480	1853-0244
A9Q4	1854-0548		TSTR:SI NPN	80131	2N5963
A9Q5	1854-0548		TSTR:SI NPN	80131	2N5963
A9Q6	1853-0086		TSTR:SI PNP	80131	2N5087
A9Q7	1854-0215		TSTR:SI NPN	80131	2N3904
A9R1	0761-0074		R:FXD MET OX 15K OHM 5% 1W	28480	0761-0074
A9R2	0757-0769		R:FXD FLM 51.1 OHM 1% 1/4W	28480	0757-0769
A9R3	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A9R4	0684-1221	1	R:FXD COMP 1.2K OHM 10% 1/4W	01121	CB 1221
A9R5	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A9R6	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A9R7	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A9R8	0684-2201		R:FXD COMP 22 OHM 10% 1/4W	01121	CB 2201
A9R9	0757-0404	1	R:FXD FLM 130 OHM 1% 1/8W	28480	0757-0404
A9R10	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A9R11	0757-0290		R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A9R12	0684-1061		R:FXD COMP 10 MEGOHM 10% 1/4W	01121	CB 1061
A9R13	0684-1001		R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001
A9R14	0761-0073	1	R:FXD MET OX 13K OHM 5% 1W	28480	0761-0073
A9R15	0684-1011		R: FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A9R16	0684-2721		R:FXD COMP 2700 OHM 10% 1/4W	01121	CB 2721
A9R17	0757-1094	1	R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A9R18	0684-4751	1	R:FXD COMP 4.7 MEGOHM 10% 1/4W	01121	CB 4751
A9R19	0684-4731		R:FXD COMP 47K OHM 10% 1/4W	01121	CB 4731
A9R20	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A9R21	0684-1041		R:FXD COMP 100K OHM 10% 1/4W	01121	CB 1041
A9R22	0757-0769	1	R:FXD FLM 51.1K OHM 1% 1/4W	28480	0757-0769
A9R23	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A9R24	0757-0422		R: FXD MET FLM 10K OHM 1% 1/8W	28480	0757-0422
A9R25	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A9R26	0757-0401	1	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A9R27	0757-0429	1	R:FXD MET FLM 1.82K OHM 1% 1/8W	28480	0757-0429
A9R28	0757-0407	1	R:FXD MET FLM 200 OHM 1% 1/8W	28480	0757-0407
A9R29	0698-3443	1	R:FXD MET FLM 287 OHM 1% 1/8W	28480	0698-3443
A9R30	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A9R31	0698-3419	1	R:FXD MET FLM 31.6K OHM 1% 1/2W	28480	0698-3419
A9R32	0684-2721		R:FXD COMP 2700 OHM 10% 1/4W	01121	CB 2721
A9R33	0684-3901		R:FXD COMP 39 OHM 10% 1/4W	01121	CB 3901
A9R34	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A9R35	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A9R36	0684-1011		R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011
A9R37	0757-0724	1	R:FXD FLM 392 OHM 1% 1/4W	28480	0757-0724
A9R38	0757-0789				
A9R39	0684-2211		R: FXD COMP 220 OHM 10% 1/4W	01121	CB 2211
A9U1	1826-0086		IC:LINEAR OP. AMPL.	07263	U5B7776393
A9U2	1821-0002	1	TRANSISTOR ARRAY:SI NPN	02735	CA3045
A9U3	1820-0203		IC:OPERATIONAL AMPLIFIER	07263	SL8940
A10	01824-66507	1	ASSY:MAINFRAME CONNECTOR	28480	01824-66507
A10C1	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A10J1	1200-0441		SOCKET:IC 14 PIN MINIATURE	28480	1200-0441
A10P1	1251-0136	1	CONNECTOR:32 PIN MALE	02660	26-4100-32P
A10R1	0687-3951	1	R:FXD COMP 3.9 MEGOHM 10% 1/2W	01121	EB 3951
A10R2	0698-3152	1	R: FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152

Table 6-3. List of Manufacturers' Codes

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00000	U. S. A. COMMON	ANY SUPPLIER OF U. S. A.	
00853	SANGAMO ELECTRIC CO. PICKENS DIV.	PICKENS, S. C.	29671
01121	ALLEN BRADLEY CO.	MILWAUKEE, WIS.	53204
02114	DERROXCUBE CORP.	SAUGERTIES, N. Y.	12477
02660	AMPHENOL CORP.	BROADVIEW, ILL.	60153
02735	RADIO CORP. OF AMERICA, SEMICONDUCTOR AND MATERIALS DIV.	SOMERVILLE, N. J.	08876
04713	MOTOROLA SEMICONDUCTOR PROD. INC.	PHOENIX, ARIZ.	85008
07263	FAIRCHILD CAMERA & INST. CORP. SEMICONDUCTOR DIV.	MOUNTAIN VIEW, CALIF.	94040
08806	GENERAL ELECTRIC CO. MINIAT. LAMP DEPT.	CLEVELAND, OHIO	44117
14655	CORNELL DUBLIER ELECT. DIV. FEDERAL PACIFIC ELECT. CO.	NEWARK, N. J.	07105
24931	SPECIALTY CONNECTOR CO. INC.	INDIANAPOLIS, IND.	46227
28480	HEWLETT–PACKARD COMPANY	PALO ALTO, CALIF.	94304
56289	SPRAGUE ELECTRIC CO.	N. ADAMS, MASS.	01247
71590	GLOBE UNION INC. CENTRALAB DIV.	MILWAUKEE, WISC.	53201
72136	ELECTRO MOTIVE MFG. CO. INC.	WILLIMANTIC, CONN.	06226
72982	ERIE TECHNOLOGICAL PROD. INC.	ERIE, PA.	16512
74970	JOHNSON E. F. CO.	WASECA, MINN.	56093
80131	ELECTRONIC INDUSTRIES ASSOCIATION	WASHINGTON D. C.	20006
84411	TRW CAPACITOR DIV.	OGALLALA, NEBR.	69153
95354	METHODE MFG. CO.	ROLLING MEADOWS, ILL.	60656
98291	SEALECTRO CORP.	MAMARONECK, N. Y.	10544
99800	DELEVAN ELECTRONICS CORP.	E. AURORA, N. Y.	14052

SECTION VII

MANUAL CHANGES AND OPTIONS

7-1. INTRODUCTION.

7-2. This section contains information required to backdate or update this manual for a specific instrument. Description of special options and standard options are also in this section.

7-3. MANUAL CHANGES.

7-4. This manual applies directly to the instrument having the same serial prefix shown on the manual title page. If the serial prefix of the instrument is not the same as the one on the title page, find your serial prefix in table 7-1 and make the changes to the manual that are listed for that serial prefix. When making changes listed in table 7-1, make the change with the highest number first. Example: if backdating changes 1, 2, and 3 are required for your serial prefix, do change 3 first, then change 2, and finally change 1. If the serial prefix of the instrument is not listed either in the title page or in table 7-1, refer to an enclosed MANUAL CHANGES sheet for updating information. Also, if a MANUAL CHANGES sheet is supplied, make all indicated ERRATA corrections.

Table 7-1. Manual Changes

Serial Prefix	Make Changes
1206A	1, 2, 3, 4, 5
1211A	2, 3, 4, 5
1228A	3, 4, 5
1309A	4, 5
1322A	5

CHANGE 1

Table 6-2,
Delete: A5CR7.
A8CR7: Change to HP Part No. 1901-0040, DIODE: SILICON 30 MA 30 WV, Mfr. Code 07263, Mfr. Part No. FDG 1088.
Schematic 4,
Delete: A5CR7.

CHANGE 2

Table 6-2,
Delete A1C42.
A1: Change HP Part No. and Mfr. Part No. to 01825-66501.
A1R39: Change to HP Part No. 0684-4701, R: FXD COMP 47 OHM 10% 1/4W, Mfr. Code 01121, Mfr. Part No. CB 4701.
A1R112: Change to HP Part No. 0684-1021, R: FXD COMP 1000 OHM 10% 1/4W, Mfr. Code 01121, Mfr. Part No. CB 1021.
A1R117, A1R119: hanj to HP Part No. 0684-1011, R:FXD COMP 100 OHM 10% 1/4W, Mfr. Code 01121, Mfr. Part No. CB 1011.
A9R24: Change to HP Part No. 0684-1031, R: FXD COMP 10K OHM 10% 1/W, Mfr. Code 01121, Mfr. Part No. 0757-0422.
Schematic 2,
Delete: A1C42.
Change value of A1R39 to 47.
Schematic 5,
Change value of A1R112 to 1000.
Schematic 10,
Change value of A1R117 and A1R119 to 100.

CHANGE 3

W1: Change HP Part No. and Mfr. Part No. to 01825-61612.

CHANGE 4

Table 6-2,
Delete: A4R15.
A4: Change HP Part No. and Mfr. Part No. to 01825-66504.
Schematic 7,
Delete: A4R15.

CHANGE 5

Table 6-2,
Delete: A8CR8.
A8VR1: Change to HP Part No. 1902-0041, DIODE: BREAKDOWN 5.11V 5%, Mfr. Code 04712, Mfr. Part No. SZ10939-98.
Schematic 7,
Change schematic 7 as shown in figure 7-1.

7-5. SPECIAL OPTIONS.

7-6. Most customer special application requirements and/or specifications can be met by factory modification of a standard instrument. A standard instrument modified in this way will carry a special option number, such as Model 0000A/Option C01.

7-7. An operating and service manual and a manual insert are provided with each special option instrument. The operating and service manual contains information about the standard instrument. The manual insert for the special option describes the factory modifications required to produce the special option instrument. Amend the operating and service manual by changing it to include all manual insert information (and MANUAL CHANGES sheet information, if applicable). When these changes are made, the operating and service manual will apply to the special option instrument.

7-8. If you have ordered a special option instrument and the manual insert is missing, notify the nearest Hewlett-Packard Sales/Service Office. Be sure to give a full description of the instrument, including the complete serial number and special option number.

7-9. STANDARD OPTIONS.

7-10. Standard options are modifications installed on HP instruments at the factory and are available on request. Contact the nearest Hewlett-Packard Sales/Service Office for information concerning standard options.

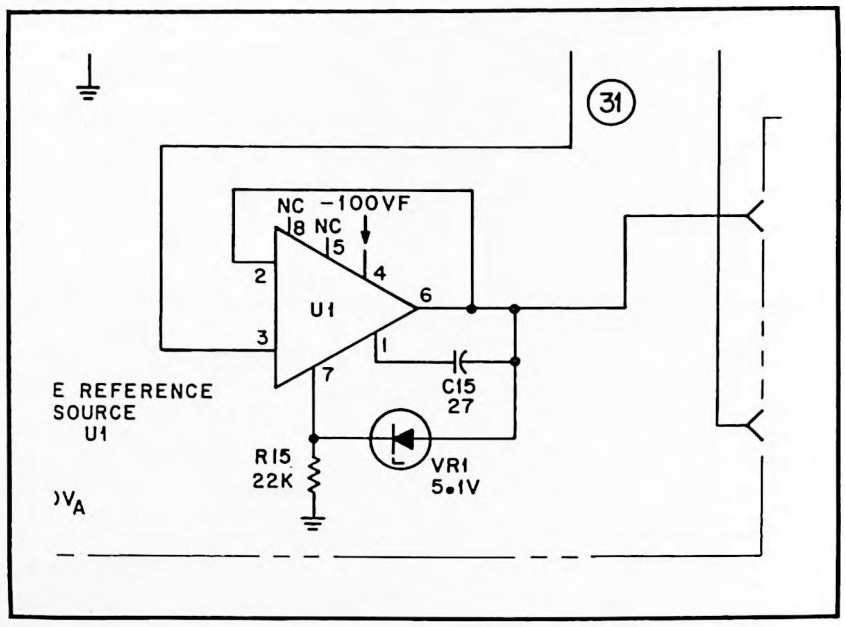


Figure 7-1. Schematic Changes

MANUAL CHANGES

MODEL 1825A

TIME BASE AND DELAY GENERATOR

Manual Serials Prefixed. 1348A
Manual Printed: Nov 73

Make all changes listed below as Errata. Check the following table for your instrument serial prefix and/or serial number and make listed change(s) to the manual:

Serial Prefix or Number	Make Changes	Serial Prefix or Number	Make Changes
1514A	1		

ERRATA

Page 4-4, paragraph 4-95,
A1U1A and A1U1B: Change to read A1U2A and A1U2B.

Page 4-4, paragraph 4-100,
Change the last line to read:
(lines (24), (25), and (25A)) go more positive.

Page 5-7, paragraph 5-49, step b,
HOLDOFF: Change setting to read ccw.

Page 5-8, table 5-2,
Add: Asterisk beside step numbers 19 through 23.
Add: Note below table as follows: *Set AUTO/NORM to NORM for these test steps.

Page 5-8, paragraph 5-58, step e,
50 ms: Change to read 50 ns.

Page 5-16, figure 5-9,
The following reference designators appear in line under the upper photograph: A4C3, A8R3, A8R1 (HIDDEN), A8R3. Change to read A4C3, A8R4, A8R1 (HIDDEN), A8R3.

Table 6-2,

Δ DS2: Change to HP Part No. 2140-0018, LAMP: GLOW 1.0 MILLIAMPS 0.1W, Mfr Code 08806, Mfr Part No. A9A-C (NE-2E1).
MP7: Change to HP Part No. 1140-0036, DIAL: TURNS COUNTING, Mfr Code 28480, Mfr Part No. 1140-0036.

Δ MP15: Change to HP Part No. 01841-23702, SHAFT: DELAYED SWEEP, Mfr Code 28480, Mfr Part No. 01841-23702.

Δ MP16: Change to HP Part No. 01841-63702, SHAFT: MAIN SWEEP, Mfr Code 28480, Mfr Part No. 01841-63702.

Δ MP17: Change HP Part No. and Mfr Part No. to 01841-63704.

Table 6-2 (Cont'd),
A1C11: Change to HP Part No. 0160-3451, C:FXD CER 0.01 UF +80–20% 100VDCW, Mfr Code 56289, Mfr Part No. C023B101F103ZS25-CD.
A1C36: Change to HP Part No. 0160-3451, C:FXD CER 0.01 UF +80–20% 100VDCW, Mfr Code 56289, Mfr Part No. C023B101F103ZS25-CD.
A1J1: Change to HP Part No. 1251-1968, CONNECTOR:PC 10 TUNING FORK TYPE CONT, Mfr Code 02660, Mfr Part No. 143-010-07-1158.
Add: A1R133, HP Part No. 0757-0441, R:FXD MET FLM 8250 OHM 1% 1/8W, Mfr Code 28480, Mfr Part No. 0757-0441.

Δ Add: A1R134, HP Part No. 0757-0416, R:FXD MET FLM 511 OHM 1% 1/8W, Mfr Code 28480, Mfr Part No. 0757-0416.

Δ A1VR2: Change to HP Part No. 1902-3094, DIODE: BREAKDOWN 5.11V 2% 400MW, Mfr Code 15818, Mfr Part No. CD35622.

Δ A1VR6: Change to HP Part No. 1902-3094, DIODE: BREAKDOWN 5.11V 2% 400MW, Mfr Code 15818, Mfr Part No. CD35622.

Add: A2XU1, HP Part No. 1200-0763, SOCKET: IC 8-PIN FOR TO-5 CASE, Mfr Code 71785, Mfr Part No. 133-98-92-061.
Add: A2XU2, HP Part No. 1200-0763, SOCKET: IC 8-PIN FOR TO-5 CASE, Mfr Code 71785, Mfr Part No. 133-98-92-061.
A4C4: Change to HP Part No. 0160-3541, C:FXD POLY 0.01 UF 5% 100VDCW, Mfr Code 84411, Mfr Part No. HEW-192.
A4R15: Change to HP Part No. 0757-0093, R:FXD FLM TUBULAR 39K OHM 2% 1/4W, Mfr Code 28480, Mfr Part No. 0757-0093.

Δ A5Q8: Change to HP Part No. 1854-0691, TSTR:SI NPN, Mfr Code 28480, Mfr Part No. 1854-0691.

7 April 1975

Δ = Latest additions to this change sheet.

This change sheet supersedes all prior change sheets for this manual.

Supplement A for
01825-90902

ERRATA (Cont'd)

Table 6-2 (Cont'd),

Δ A5Q9: Change to HP Part No. 1854-0691, TSTR:SI NPN, Mfr Code 28480, Mfr Part No. 1854-0691.
A8C6: Change to HP Part No. 0160-3541, C:FXD POLY 0.01 UF 5% 100VDCW, Mfr Code 84411, Mfr Part No. HEW-192.

Δ A9 (page 6-9 only): Change description to ASSY: MAIN SWEEP COMPONENTS 2.

Δ A9C1: Change description to read C:FXD CER 15 PF 5% 500WVDC.

Δ A9Q4: Change to HP Part No. 1854-0691, TSTR:SI NPN, Mfr Code 28480, Mfr Part No. 1854-0691.

Δ A9Q5: Change to HP Part No. 1854-0691, TSTR:SI NPN, Mfr Code 28480, Mfr Part No. 1854-0691.

Δ A9R38: Change to HP Part No. 0698-4798, R:FXD MET FLM 487K 1% 1/4W, Mfr Code 28480, Mfr Part No. 0698-4798.

Δ Schematic 2,
Add: A1R134 (511 ohms) from +15V to cathode of A1VR2.
Page 8-14, figure 8-14,
R27: Change designator to R22.
C12: Change designator to C6.
R22: Change designator to R27.
C6: Change designator to C1.

Δ Schematic 6,
A9R38: Change value to 487K.

Δ CHANGE 1

Table 6-2,
A6: Change HP Part No. and Mfr Part No. to 01824-66513.
A10: Change HP Part No. and Mfr Part No. to 01824-66513.
W15: Change HP Part No. and Mfr Part No. to 01824-61608.
W16: Change HP Part No. and Mfr Part No. to 01825-61618.

Schematics 8 and 9,
Revise the pin connections between A6J1 and A10P1 according to figure 1 of this manual changes sheet.

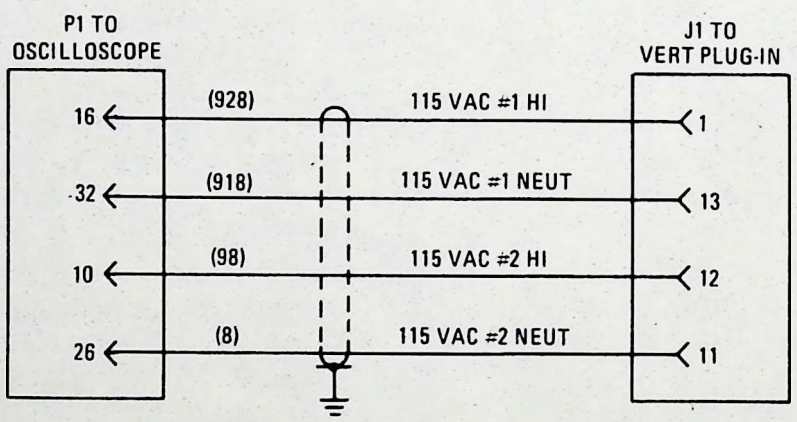


Figure 1. Power Cable Change

SECTION VIII

SCHEMATICS AND TROUBLESHOOTING

8-1. INTRODUCTION.

8-2. This section contains schematics, repair and replacement information, component-identification illustrations, waveforms, test conditions, troubleshooting procedures and a troubleshooting block diagram. Table 8-1 defines symbols and conventions used in the schematics.

8-3. SCHEMATICS.

8-4. Schematics are printed on foldout pages for easy reference to the text and illustrations in other sections. The schematics are drawn to show the electronic function of the circuits. Any one schematic may include all or part of several different physical assemblies.

8-5. The schematics are numbered in sequence with a bold number in a box at the lower right-hand corner of each schematic. These numbers are used to cross reference connections between schematics. At each circuit breaking point, a number in a circle is shown, followed by another number in bold type. The circled number indicates the signal or circuit and the bold number indicates the associated schematic which contains the source or destination of the signal. To find the source or destination of a signal, turn to the indicated schematic and find the circled number in question. The name of the circuit or signal identified by the circled numbers can be found in the table to the left of the schematic. As an aid to signal tracing, the circled numbers are also used to identify troubleshooting paths on the troubleshooting block diagram. No matter where it is found in this section, a particular circled number always identifies the same signal or circuit.

8-6. A table on each schematic lists all components shown on the schematic by reference designations. Components not physically located on an etched circuit board are shown in the unshaded areas of the schematic.

8-7. All components within the shaded area of a schematic are physically located on etched circuit boards. Components not physically located on an etched circuit board are shown in the unshaded areas of the schematic.

8-8. REFERENCE DESIGNATIONS.

8-9. The unit system of reference designations used in this manual is in accordance with the provisions of USA Standard Y32.16-1968, Reference Designations for Electrical and Electronics Parts and Equipments, dated March 1, 1968. Minor variations from the standard due to design and manufacturing practices may be noted.

8-10. Each electrical component is assigned a class letter and number. This letter-number combination is the basic reference designation. Components which are not part of an assembly have only the basic reference designation. Components which are part of an assembly have, in addition to the basic reference designation, a prefix designation indicating the assembly of which the component is a part. For instance, resistor R23 on assembly A1 is called A1R23 and resistor R23 on assembly A3 is called A3R23.

8-11. Assemblies are numbered consecutively. If an assembly reference designation is assigned and later deleted, that designation is not reused.

8-12. COMPONENT LOCATIONS.

8-13. Locations of components on assemblies and subassemblies are illustrated in photographs adjacent to the schematics. Components located on the chassis are identified in figure 8-2.

8-14. REPAIR AND REPLACEMENT.

8-15. The following paragraphs provide procedures for removal and replacement of assemblies, subassemblies, and components. Special servicing instructions for the printed circuit boards are covered in paragraph 8-25. Section VI provides detailed parts list for use in ordering replacement parts.

8-16. SEMICONDUCTOR REPLACEMENT.

8-17. Figure 8-1 is included to identify the leads for common shapes and types of semiconductor devices. When removing a semiconductor, use long-nosed pliers as a heat sink between the device and the soldering iron. When replacing a semiconductor, ensure sufficient lead length to dissipate the soldering heat by using the same length of exposed lead as used for the original part.

8-18. BOARD CONNECTIONS.

8-19. Soldered connections are identified on circuit boards by the color code of the connecting wire.

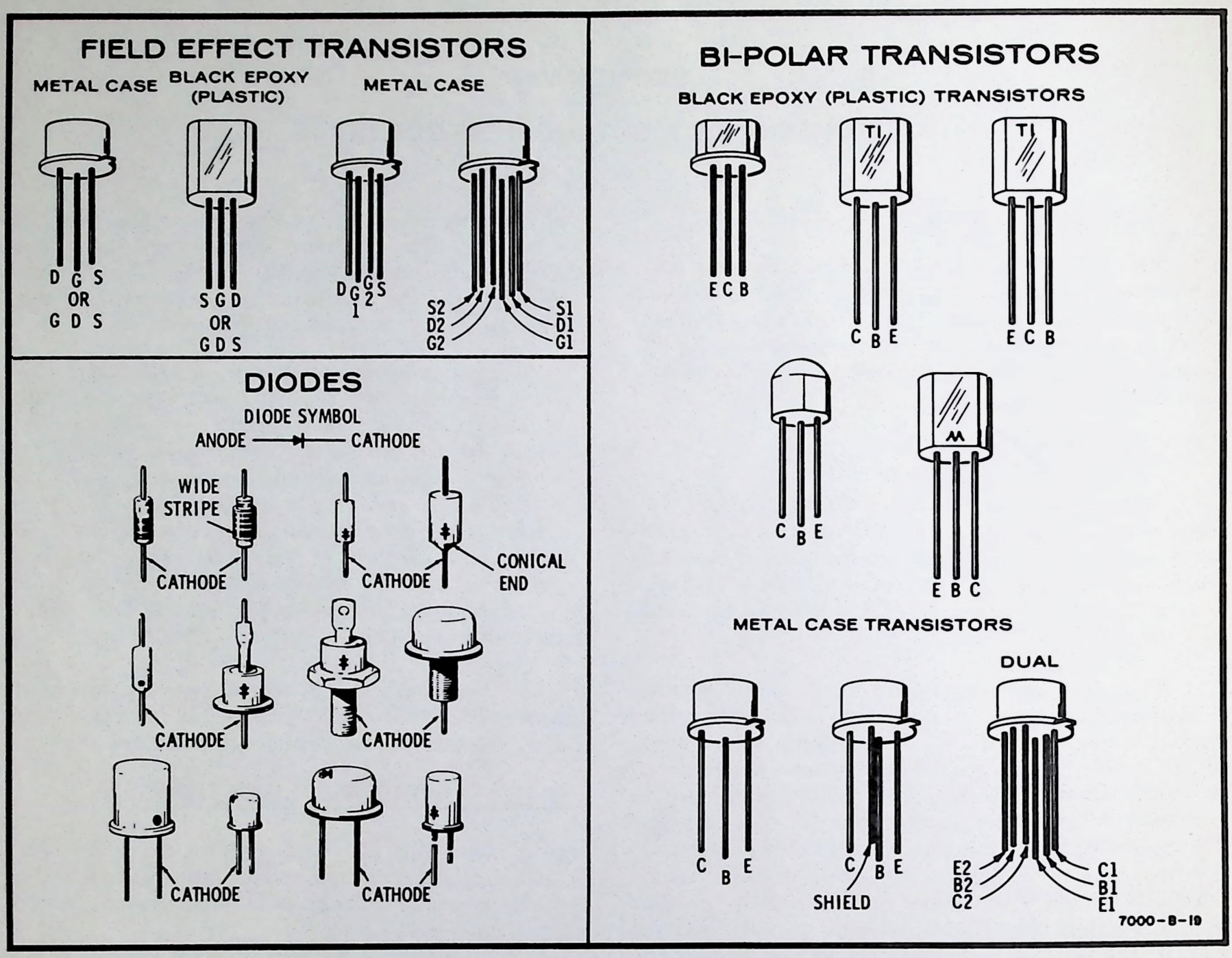


Figure 8-1. Semiconductor Terminal Identification

Connector pins on plugs and jacks are identified by a number or a letter. The letters G, I, O, and Q have been omitted. Table 8-1 shows the types of board connections used in the instrument.

8-20. BOARD REMOVAL.

8-21. Boards A1, A2, A3, A6, and A10 can be taken out by removing mounting screws, disconnecting jacks and square pin connectors, and in some cases, unsoldering connecting wires. Before disconnecting any wires, write down wire color codes and note position of wires on the boards.

CAUTION

Miswiring during reassembly can result in damage to instrument components.

8-22. Boards A4, A5, A7, A8, and A9 can be removed only after removal of TIME/DIV switch shaft.

8-23. To remove TIME/DIV switch shaft, proceed as follows:

a. Loosen setscrew in dial spacer assembly MP12.

b. Set MAIN TIME/DIV to 1 SEC.

c. Set DELAYED TIME/DIV to 20 uSEC.

d. Note positions of A5S1 and A8S1.

e. Pull outward on dial spacer assembly and remove shaft assembly.

f. A4, A5, A7, A8, and A9 can now be removed by pulling each board upward.

8-24. To reinstall TIME/DIV shaft, proceed as follows:

a. Reseat A4, A5, A7, A8, and A9.

b. Ensure that A5S1, and A8S1 are set in positions noted in paragraph 8-23 steps b and c.

c. Insert shaft through both switches.

d. Push shaft inward until dial spacer assembly MP12 is firmly against front panel. Tighten setscrew.

8-25. SERVICING PRINTED CIRCUIT BOARDS.

8-26. This instrument uses printed circuit boards with plated-through components holes. This allows components to be removed or replaced by unsoldering from either side of the board. When removing large components, such as potentiometers, rotate the soldering iron tip from lead to lead while applying pressure to the part to lift it from the board. HP Service Note M-20E contains additional information on repairs of printed circuit boards.

8-27. SWITCH MAINTENANCE.

8-28. Switches A5S1 and A8S1 can be serviced after removal of TIME/DIV switch shaft (paragraph 8-23).

8-29. To disassemble the switches, remove retainer spring (MP26 or MP27); then the two rotor sections can be separated from the printed circuit board. If the contact areas of the printed circuit board or the two rotors show excessive wear, replace worn parts. For cleaning, spray with a degreaser comparable to MS-180 FREON TF DEGREASER produced by Miller-Stephenson Chemical Co., Inc., and lightly lubricate the contact areas of the printed circuit boards and rotor sections. Lubricate contact areas with a lubricant comparable to LUBRIPLATE FML produced by Fiske Brothers Refining Company. LUBRIPLATE FML is available from Hewlett-Packard: order HP Part No. 6040-0305.

8-30. INTEGRATED CIRCUIT REPLACEMENT.

8-31. The IC (integrated circuits) in this instrument are of two general configurations, plug-in types and those soldered in place. Remove a plug-in IC with a straight pull away from the board. Soldered IC units may be removed with soldering irons which simultaneously heat all connections (available from various manufacturers). Soldering irons with built-in desoldering tools also facilitate quick removal.

CAUTION

Unless an IC has definitely failed, be careful to prevent damage when removing or replacing it.

8-32. Use the following procedure for removing an IC with a standard soldering iron.

a. Heat IC lead solder joint. Use soldering iron with small pencil tip (e. g. Weller No. PT-H7).

b. When solder is fluid, remove it with desoldering tool (such as deluxe Model Soldapullt manufactured by Edsyn Company of California).

c. Repeat steps a and b for each IC lead until all leads are free.

d. Grasp each lead with long-nosed pliers and check that it is mechanically free from circuit board.

e. When all leads are free, carefully remove IC. Dual-in-line type may be removed by gently gripping top and bottom with long-nosed pliers and rolling IC out.

f. Use desoldering tool or toothpick to remove all remaining solder from circuit board holes.

g. Insert replacement IC into circuit board and solder it in place.

CAUTION

Be careful not to damage the IC by heat from the soldering iron. Work quickly.

8-33. When replacing an IC, note the mark or notch used for orientation. The component identification photos and the IC pin-location diagrams of this manual show IC orientation.

8-34. TROUBLESHOOTING.

8-35. The most important prerequisite for successful troubleshooting is understanding how the instrument is designed to operate and correct use of front-panel controls. Improper control setting or circuit connections can cause apparent malfunctions. Read Section III (Operating Procedure) for an explanation of controls and general operating considerations, and Section IV (Principles of Operation) for an explanation of circuit theory.

8-36. If trouble is suspected, visually inspect the instrument. Look for loose or burned components that might suggest a source of trouble. Check to see that all circuit board connections are making good contact and are not shorting to an adjacent circuit. If no obvious trouble is found, check the power supply voltages from the mainframe. Ensure that auxiliary equipment being used is operating properly.

8-37. DC VOLTAGES AND WAVEFORMS.

8-38. All numbered points on the troubleshooting block diagram and corresponding points on the schematics show dc voltages and, if appropriate, waveforms. Table 8-3, adjacent to the block diagram, provides the location of the measurement point and conditions under which the measurement must be made. Since the conditions for making these measurements differ from one circuit to another, always check the specific condition for a particular measurement.

8-39. CHECKING DC VOLTAGES.

8-40. DC voltage troubles, especially shorts, can be difficult to trace because of the large number of stages supplied by a particular dc voltage source. Schematic 10 (overleaf from schematic 9) has been included to make troubleshooting of this type easier by providing complete dc voltage distributions on a single schematic.

8-41. CIRCUIT CHECKING.

8-42. The troubleshooting block diagram (figure 8-4) has been provided to enable rapid isolation of a malfunction to a particular circuit group. This is accomplished by making indicated measurements until a block is found whose inputs are normal but whose outputs are abnormal. Once this point is reached, the numbered input and output points are located on the appropriate schematic and progressive troubleshooting techniques (waveform analysis, voltage measurement, resistance measurement, substitution) are employed between the two points to isolate the malfunction to a particular component(s).

8-43. To use the troubleshooting block diagram, proceed as follows:

a. Install Model 1825A as instructed in Section II and perform initial turn-on (as far as malfunction will permit) as instructed in Section III.

b. Make all measurements possible on mother board or directly on leads of components.

c. Ensure that auxiliary equipment is operating properly.

d. Ensure that all power supply voltages are present and within tolerance.

e. Determine effect of all operating controls on output. This will enable logical selection of most direct troubleshooting path to malfunction. Of course, if all else fails, inputs and outputs of each block can be tested to find malfunctioning block.

f. After locating desired measurement point on block diagram, refer to corresponding number on adjacent table 8-3. Table 8-3 provides physical location of measurement and test condition for making indicated measurement. Chassis parts locations are shown in figure 8-2. PC board component locators are adjacent to schematics.

g. Set up Model 1825A and test equipment as shown in figure 8-3.

h. Make measurement and compare waveform or voltage on block diagram.

Table 8-1. Schematic Notes

Refer to MIL-STD -15-1A for schematic symbols not listed in this table.

= Etched circuit board

= Front-panel marking

= Rear-panel marking

= Front-panel control

= Screwdriver adjustment

P/O = Part of

CW = Clockwise end of variable resistor

NC = No connection

= Waveform test point (with number)

= Common electrical point (with letter) not necessarily ground

= Single-pin connector on board

= Pin of a plug-in board (with letter or number)

= Coaxial cable connected to snap-on jack

= Coaxial cable connected directly to board

= Wire connected to pressure-fit socket on board

= Main signal path

= Primary feedback path

= Secondary feedback path

= Field-effect transistor (P-type base)

= Field-effect transistor (N-type base)

= Breakdown diode (voltage regulator)

= Tunnel diode

= Step-recovery diode

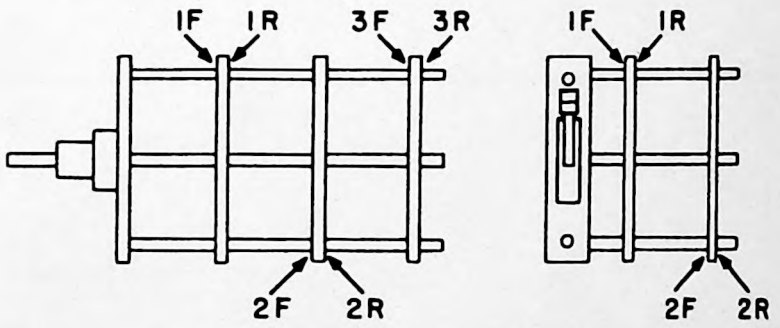
= Circuits or components drawn with dashed lines (phantom) show function only and are not intended to be complete. The circuit or component is shown in detail on another schematic.

(925) = Wire colors are given by numbers in parentheses using the resistor color code

[(925) is wht-red-grn]

0 - Black	5 - Green
1 - Brown	6 - Blue
2 - Red	7 - Violet
3 - Orange	8 - Gray
4 - Yellow	9 - White

Switch wafers are identified as follows:



* = Optimum value selected at factory, typical value shown; part may have been omitted.

Unless otherwise indicated:
resistance in ohms
capacitance in picofarads
inductance in microhenries

Notes

bols not listed in this table.

D
S = Field-effect transistor (P-type base)

D
S = Field-effect transistor (N-type base)

= Breakdown diode (voltage regulator)

= Tunnel diode

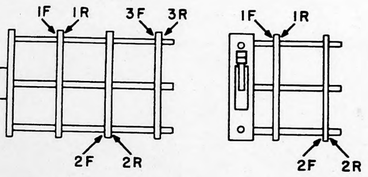
= Step-recovery diode

= Circuits or components drawn with dashed lines (phantom) show function only and are not intended to be complete. The circuit or component is shown in detail on another schematic.

= Wire colors are given by numbers in parentheses using the resistor color code
[(925) is wht-red-grn]

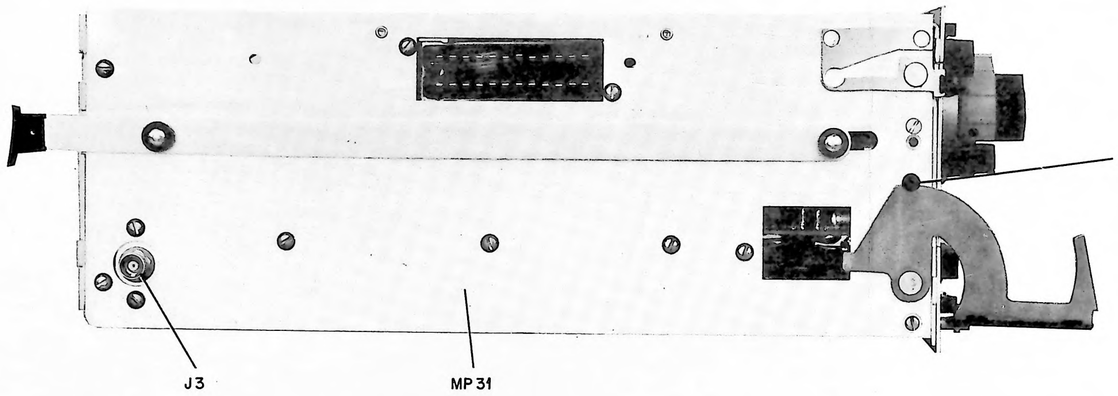
0 - Black
1 - Brown
2 - Red
3 - Orange
4 - Yellow
5 - Green
6 - Blue
7 - Violet
8 - Gray
9 - White

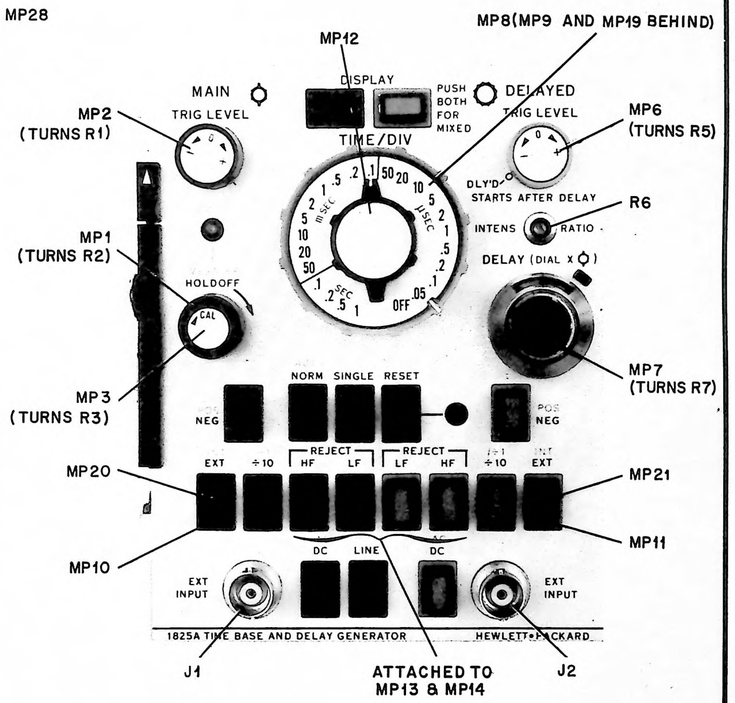
Switch wafers are identified as follows:

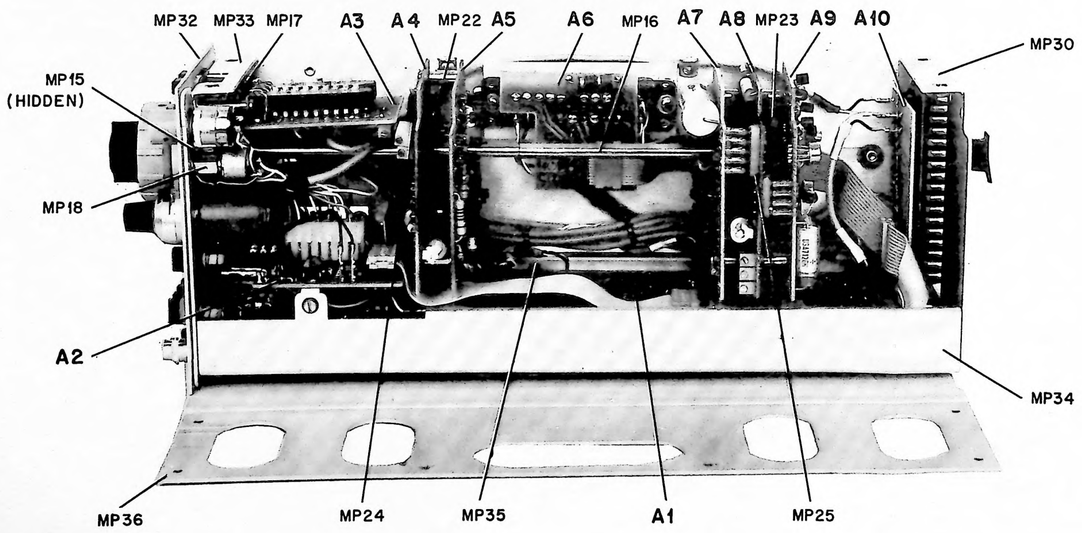


= Optimum value selected at factory, typical value shown; part may have been omitted.

Unless otherwise indicated:
resistance in ohms
capacitance in picofarads
inductance in microhenries







1825A-B-1

Figure 8-2.
Chassis Parts Locator

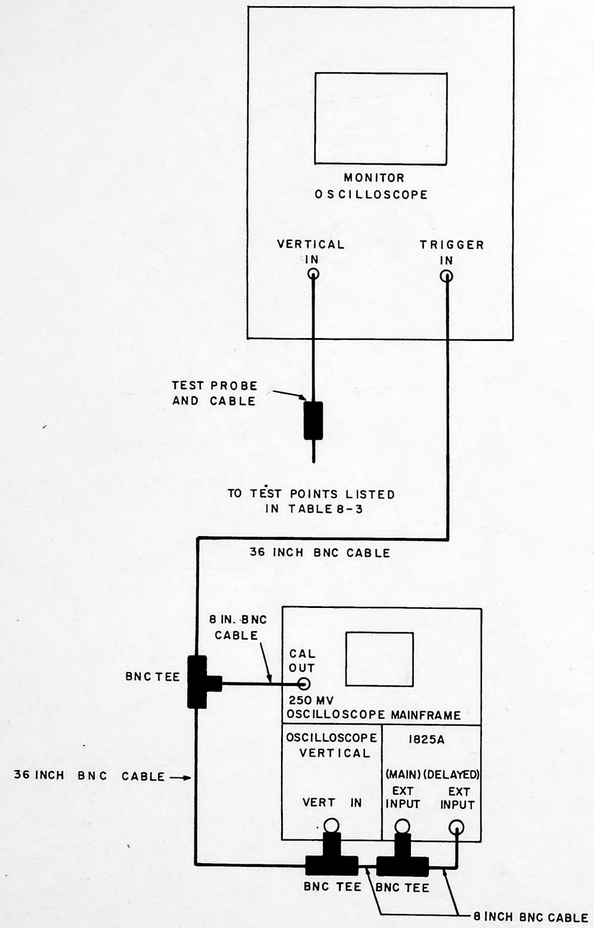


Figure 8-3. Troubleshooting Test Setup

TEST CONDITION A

Connect equipment as shown in figure 8-3.
Set Model 1825A controls as follows:

DISPLAY	MAIN
MAIN TIME/DIV	.2 mSEC
DELAYED TIME/DIV	OFF
MAIN POS/NEG	NEG
AUTO/NORM	NORM
MAIN INT/EXT	EXT
MAIN ÷1/÷10	÷10
pushbuttons not mentioned	out

TEST CONDITION B

Same as A except:

MAIN TRIG LEVEL	centered
all pushbuttons	out

TEST CONDITION C

Same as A except:

MAIN INT/EXT	INT
MAIN ÷1/÷10	÷1

TEST CONDITION D

Set Model 1825A controls as follows:

DISPLAY	MAIN
MAIN TIME/DIV	.2 mSEC
DELAYED TIME/DIV	OFF
MAIN TRIG LEVEL	cw
VERNIER	detent
AUTO/NORM	NORM
SINGLE	in
pushbuttons not mentioned	out

Press RESET and observe that RESET lamp is on.

TEST CONDITION E

Same as A except measurements are taken in both positions of POS/NEG.

TEST CONDITION F

Same as A except measurements are taken in both positions of single.

TEST CONDITION G

Same as A except measurements are taken in both extremes of HOLDOFF.

TEST CONDITION H

Same as A except measurements are taken in both extremes of VERNIER.

TEST CONDITION I

Same as A except:

LINE	in

TEST CONDITION J

Connect equipment as shown in figure 8-3.
Set Model 1825A controls as follows:

DISPLAY	DELAYED
MAIN TIME/DIV	.2 mSEC
DELAYED TIME/DIV	.2 mSEC
MAIN POS/NEG	NEG
DELAYED POS/NEG	NEG
MAIN INT/EXT	EXT
DELAYED INT/EXT	EXT
MAIN ÷1/÷10	÷10
DELAYED ÷1/÷10	÷10
DELAY dial	ccw
pushbuttons not mentioned	out

TEST CONDITION K

Same as J except all pushbuttons (except DISPLAY) are out.

TEST CONDITION L

Same as J except:

DISPLAY	MIXED
MAIN TIME/DIV	.5 mSEC

Adjust MAIN then DELAYED TRIG LEVEL for triggered display.

TEST CONDITION M

Set Model 1825A controls as follows:

DISPLAY	DELAYED
MAIN TIME/DIV	.2 mSEC
DELAYED TIME/DIV	.1 mSEC
MAIN TIRG LEVEL	cw
DELAYED TRIG LEVEL	cw
VERNIER	detent
AUTO/NORM	NORM
SINGLE	in
pushbuttons not mentioned	out

Press RESET and observe that RESET lamp is on.

TEST CONDITION N

Same as J except measurements are made in both extremes of DELAYED TRIG LEVEL.

TEST CONDITION O

Same as J except measurements are made in both positions of DELAYED POS/NEG.

TEST CONDITION P

Same as J except DELAYED TRIG LEVEL is set to DELY'D STARTS AFTER DELAY.

TEST CONDITION Q

Same as M except:

DELAY dial	9.00

Table 8-3. Bloc

No.	Signal Name
1	Line trigger
2	Main external trigger
3	Main internal trigger
4	Main trigger input, LF impedance conve
5	Main trigger input, HF impedance conve
6	Main trigger level voltage
7	Main trigger output, LF impedance conv
8	Main trigger output, HF impedance conv
9	Polarity switch control voltage
10	Polarity switch control voltage
11	Main polarity switch input
12	Main polarity switch input
13	Main polarity switch output
14	Main polarity switch output
15	Main trigger amplifier positive output
16	Main trigger amplifier negative output
17	Single sweep control voltage
18	Main trigger enable control voltage
19	Free-run trigger
20	Free-run enable voltage
21	Main dual Schmitt output
22	Auto and lockout output
23	Internal display enable voltage
24	Main gate to rear panel
25	Main integrator gate
25A	Main gate to gate Schmitt
26	Holdoff control voltage
27	Holdoff ramp
28	Main feedback ramp
29	Main ramp to rear panel
30	Vernier control voltage
31	Main integrator input
32	Main ramp to comparator
33	Main ramp
34	Delayed external trigger
35	Delayed internal trigger

Table 8-3. Block Diagram Test Identifier

No.	Signal Name	Test Point	Test Condition
1	Line trigger	W13	I
2	Main external trigger	J1	A
3	Main internal trigger	Junction-A1R1, A1S1A	C
4	Main trigger input, LF impedance converter	A2R8	A
5	Main trigger input, HF impedance converter	Junction-C2, R9	A
6	Main trigger level voltage	R1-center top	D
7	Main trigger output, LF impedance converter	A1U1-pin 1	A
8	Main trigger output, HF impedance converter	A1U1-pin 10	A
9	Polarity switch control voltage	Junction-R15, R19	E
10	Polarity switch control voltage	Junction-R17, R19	E
11	Main polarity switch input	Q3-emitter	E
12	Main polarity switch input	Q6-emitter	E
13	Main polarity switch output	A1U1-pin 7	E
14	Main polarity switch output	A1U1-pin 4	E
15	Main trigger amplifier positive output	A1U2-pin 6	A
16	Main trigger amplifier negative output	A1U2-pin 9	A
17	Single sweep control voltage	A1P3-pin 10	F
18	Main trigger enable control voltage	A1TP7	A
19	Free-run trigger	A1Q7-emitter	B
20	Free-run enable voltage	A1U2-pin 14	B
21	Main dual Schmitt output	A1TP5	A
22	Auto and lockout output	A1J2-pin	F
23	Internal display enable voltage	A1Q8-base	B
24	Main gate to rear panel	W3	A
25	Main integrator gate	A1TP6	A
25A	Main gate to gate Schmitt	A1TP6	A
26	Holdoff control voltage	A1J2-pin	G
27	Holdoff ramp	A1Q4-base	A
28	Main feedback ramp	Junction-A7R21, A7C10	A
29	Main ramp to rear panel	A1TP9	A
30	Vernier control voltage	A1J2-pin	H
31	Main integrator input	A9Q4-base	D
32	Main ramp to comparator	A9Q5-collector	A
33	Main ramp	A9Q7-collector	A
34	Delayed external trigger	J2	C
35	Delayed internal trigger	Square pin-green	K

Table 8-3. Block Diagram Test Identifier (cont'd)

No.	Signal Name	Test Point	Test Condition
36	Delayed trigger input, HF impedance converter	Junction-A1R54	J
37	Delayed trigger input, LF impedance converter	A1P2-pin	J
38	Delayed trigger level voltage	R5-center tap	N
39	Delayed trigger output, HF, impedance converter	A1U3-pin 10	J
40	Delayed trigger output, LF impedance converter	A1U3-pin 1	J
41	Delayed polarity switch input	A1Q13-emitter	O
42	Delayed polarity switch input	A1Q16-emitter	O
43	Delayed polarity switch output	A1U3-pin 7	O
44	Delayed polarity switch output	A1U3-pin 4	O
45	Delayed polarity switch control voltage	Junction-A1R60, A1R63	O
46	Delayed polarity switch control voltage	Junction-A1R62, A1R64	O
47	Delayed trigger amplifier positive output	A1U5-pin 6	J
48	Delayed trigger amplifier negative output	A1U5-pin 9	J
49	Delayed starts after delay control line	A1J2-pin 1	P
50	Delayed trigger enable voltage	A1U5-pin	L
51	Delayed dual Schmitt output	A1TP4	J
52	Delayed gate to to gate Schmitt	A1TP2	J
53	Delayed gate to rear panel	Junction-A1R91, A1R92	J
54	Delayed integrator gate	A1TP2	J
55	Delayed ramp	W6	J
56	Delayed ramp to rear panel	W5	J
57	Delayed control Schmitt enable voltage	TP1	L
58	Delayed integrator input	A5P1-pin 3	G
59	Internal trigger input	W8	C
60	Delay comparison voltage	A9U1-pin 6	L
61	Delayed trigger enable voltage	A1J4-pin 1	L
62	Intensity control voltage	R6-center tap	L
63	Composite intensified gate	TP8	A
64	Main gate enable voltage	A3-wht/yel wire	Q
65	Delayed gate enable voltage	A3-wht/grn wire	Q
66	Delayed reset reference voltage	W7	A
67	Delayed feedback ramp	A5Q2-base	J
68	Composite ramp output	W10	L

st Identifier (cont'd)

	Test Point	Test Condition
	Junction-A1R54	J
	A1P2-pin	J
	R5-center tap	N
	A1U3-pin 10	J
	A1U3-pin 1	J
	A1Q13-emitter	O
	A1Q16-emitter	O
	A1U3-pin 7	O
	A1U3-pin 4	O
	Junction-A1R60, A1R63	O
	Junction-A1R62, A1R64	O
	A1U5-pin 6	J
	A1U5-pin 9	J
	A1J2-pin 1	P
	A1U5-pin	L
	A1TP4	J
	A1TP2	J
	Junction-A1R91, A1R92	J
	A1TP2	J
	W6	J
	W5	J
	TP1	L
	A5P1-pin 3	G
	W8	C
	A9U1-pin 6	L
	A1J4-pin 1	L
	R6-center tap	L
	TP8	A
	A3-wht/yel wire	Q
	A3-wht/grn wire	Q
	W7	A
	A5Q2-base	J
	W10	L

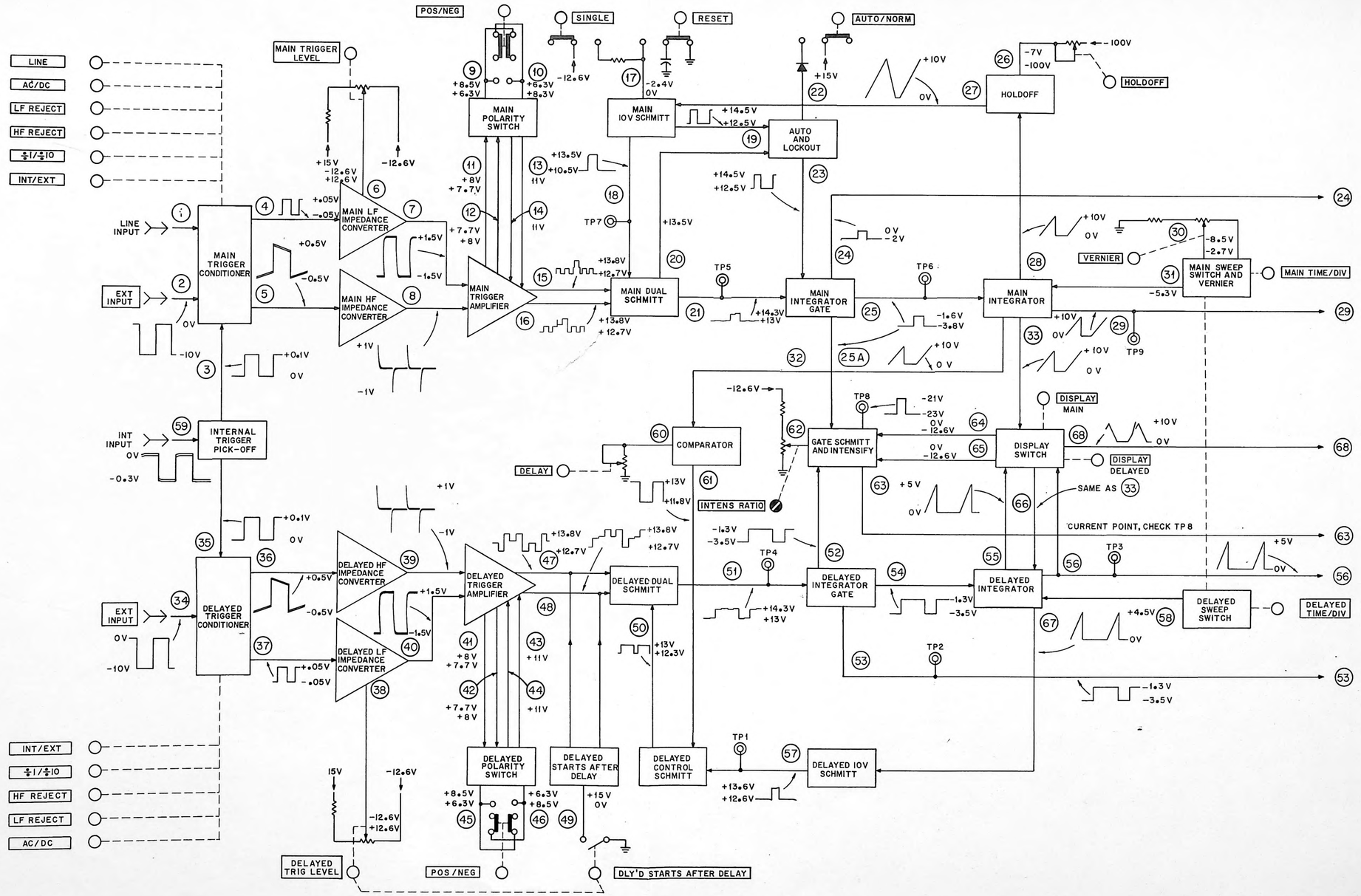
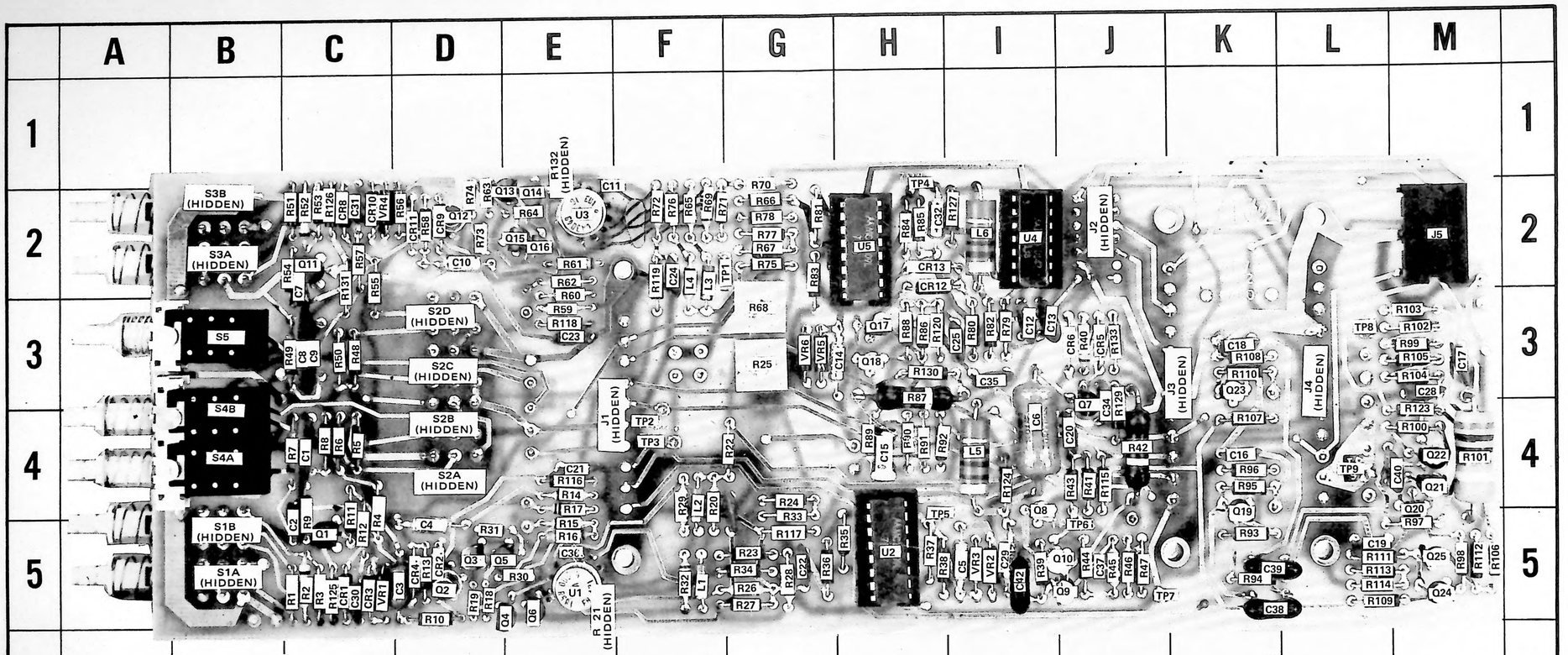


Figure 8-4.
Troubleshooting Block Diagram
8-7



Circuit boards have plated through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-4	C17	M-3	C36	E-5	CR13	H-2	Q5	E-5	Q21	M-4	R12	C-5	R28	G-5	R43	J-4	R58	D-2	R73	D-2	R88	H-3	R103	M-3	R118	E-3	S1B	B-5	TP7	K-5
C2	C-5	C18	K-3	C37	J-5	J1	D-3	Q6	E-5	Q22	M-4	R13	D-5	R29	F-4	R44	J-5	R59	E-3	R74	D-2	R89	H-4	R104	M-3	R119	F-2	S2A	D-4	TP8	L-3
C3	D-5	C19	L-5	C38	K-5	J2	J-2	Q7	J-4	Q23	K-3	R14	E-4	R30	E-5	R45	J-5	R60	E-2	R75	G-2	R90	H-4	R105	M-3	R120	H-3	S2B	D-4	TP9	L-4
C4	D-5	C20	J-4	C39	K-5	J3	K-3	Q8	I-4	Q24	M-5	R15	E-5	R31	D-5	R46	J-5	R61	E-2	R76	F-2	R91	H-4	R106	M-5	R123	M-4	S2C	D-3	U1	E-5
C5	I-5	C21	E-4	C40	M-4	J4	L-3	Q9	J-5	Q25	M-5	R16	E-5	R32	F-5	R47	J-5	R62	E-2	R77	G-2	R92	H-4	R107	K-4	R124	I-4	S3D	D-3	U2	H-5
C6	I-4	C22	G-5	C42	I-5	J5	M-2	Q10	J-5	R1	C-5	R17	E-4	R33	G-5	R48	C-3	R63	D-2	R78	G-2	R93	K-5	R108	K-3	R125	C-5	S4A	A-4	U3	E-2
C7	C-2	C23	E-3	CR1	C-5	L1	F-5	Q11	C-2	R2	C-5	R18	D-5	R34	G-5	R49	C-3	R64	E-2	R79	I-3	R94	K-5	R109	L-5	R126	C-2	S4B	A-4	U4	L-2
C8	C-3	C24	F-2	CR2	D-5	L2	F-4	Q12	D-2	R3	C-5	R19	D-5	R35	H-5	R50	C-3	R65	F-2	R80	I-3	R95	K-4	R110	K-3	R127	I-2	S5	A-3	U5	H-2
C9	C-3	C25	I-3	CR3	C-5	L3	F-2	Q13	E-2	R4	C-4	R20	F-4	R36	G-5	R51	C-2	R66	G-2	R81	G-2	R96	K-4	R111	L-5	R129	J-4	TP1	E-2	VR1	C-5
C10	D-2	C28	M-3	CR4	D-5	L4	F-2	Q14	E-2	R5	C-4	R21	E-5	R37	H-5	R52	C-2	R67	G-2	R82	I-3	R97	M-5	R112	M-5	R130	H-3	TP2	F-4	VR2	I-5
C11	E-2	C29	I-5	CR5	J-3	L5	I-4	Q15	E-2	R6	C-4	R22	G-4	R38	H-5	R53	C-2	R68	G-3	R83	G-2	R98	M-5	R113	L-5	R131	C-2	TP3	F-4	VR3	I-5
C12	I-3	C30	C-5	CR6	J-3	L6	L-2	Q16	E-2	R7	C-4	R23	G-5	R39	I-5	R54	C-2	R69	F-2	R84	H-2	R99	M-3	R114	L-5	R132	E-2	TP4	H-2	VR4	C-2
C13	I-3	C31	C-2	CR8	C-2	Q1	C-5	Q17	H-3	R8	C-4	R24	G-4	R40	J-3	R55	C-2	R70	G-2	R85	H-2	R100	M-4	R115	J-4	R133	J-3	TP5	H-5	VR5	G-3
C14	H-3	C32	H-2	CR9	D-2	Q2	D-5	Q18	H-3	R9	C-5	R25	G-3	R41	J-4	R56	D-2	R71	F-2	R86	H-3	R101	M-4	R116	E-4	S1A	B-5	TP6	J-5	VR6	G-3
C15	H-4	C34	J-4	CR10	C-2	Q3	D-5	Q19	K-4	R10	D-5	R26	G-5	R42	J-4	R57	C-2	R72	F-2	R87	H-3	R102	M-3	R117	G-5						
C16	K-4	C35	I-3	CR11	D-2	Q4	E-5	Q20	M-4	R11	C-4	R27	G-5																		
				CR12	H-2																										

1825A-R-8A

Figure 8-5. A1 Components Locator

VOLTAGE MEAS

Set Model 1825A contr

DISPLAY.....
MAIN TIME/DIV
DELAYED TIME/
MAIN TRIG LEV
VERNIER .....
AUTO/NORM ....
SINGLE .....
pushbuttons not m

Press RESET and obs
During each test, ens

WAVEFORM MEAS

Connect equipment as

Set Model 1825A contr

DISPLAY.....
MAIN TIME/DIV
DELAYED TIME/
MAIN POS/NEG .
AUTO/NORM ....
MAIN INT/EXT ..
MAIN ÷1/÷10 .....
pushbuttons not m

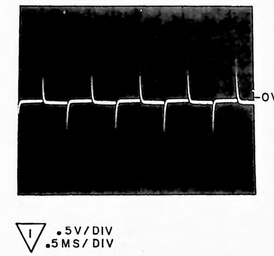


Figure 8-6. Schematic 1 Voltage and

VOLTAGE MEASUREMENT CONDITIONS

Set Model 1825A controls as follows:

DISPLAY.....MAIN
MAIN TIME/DIV ..... .2 mSEC
DELAYED TIME/DIV..... OFF
MAIN TRIG LEVEL..... cw
VERNIER ..... detent
AUTO/NORM ..... NORM
SINGLE ..... in
pushbuttons not mentioned ..... out

Press RESET and observe that RESET lamp is on. During each test, ensure that RESET lamp is on.

WAVEFORM MEASUREMENT CONDITIONS

Connect equipment as shown in figure 8-3.

Set Model 1825A controls as follows:

DISPLAY.....MAIN
MAIN TIME/DIV ..... .2 mSEC
DELAYED TIME/DIV..... OFF
MAIN POS/NEG ..... NEG
AUTO/NORM ..... NORM
MAIN INT/EXT..... EXT
MAIN ÷1/÷10 .....÷10
pushbuttons not mentioned ..... out

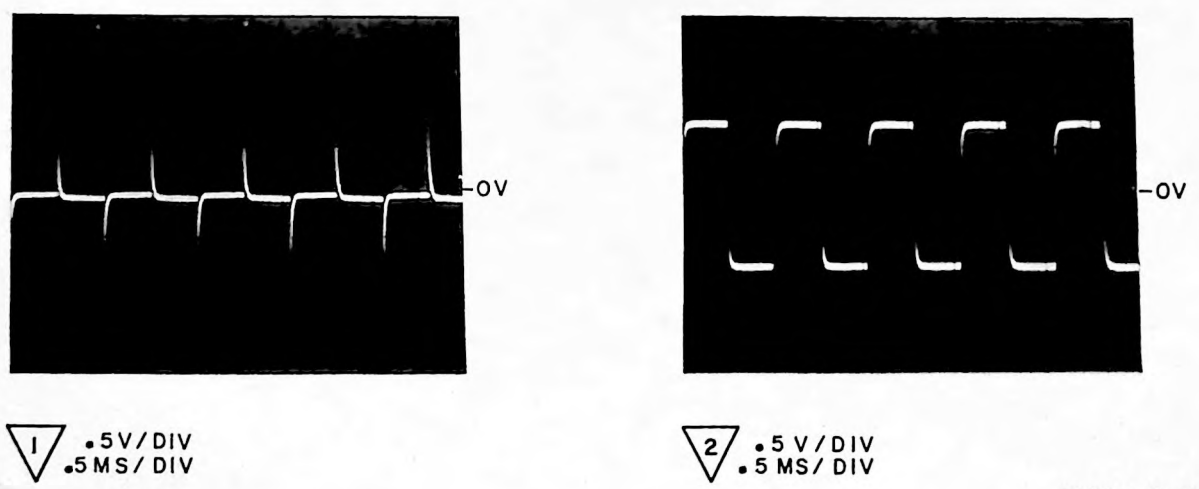
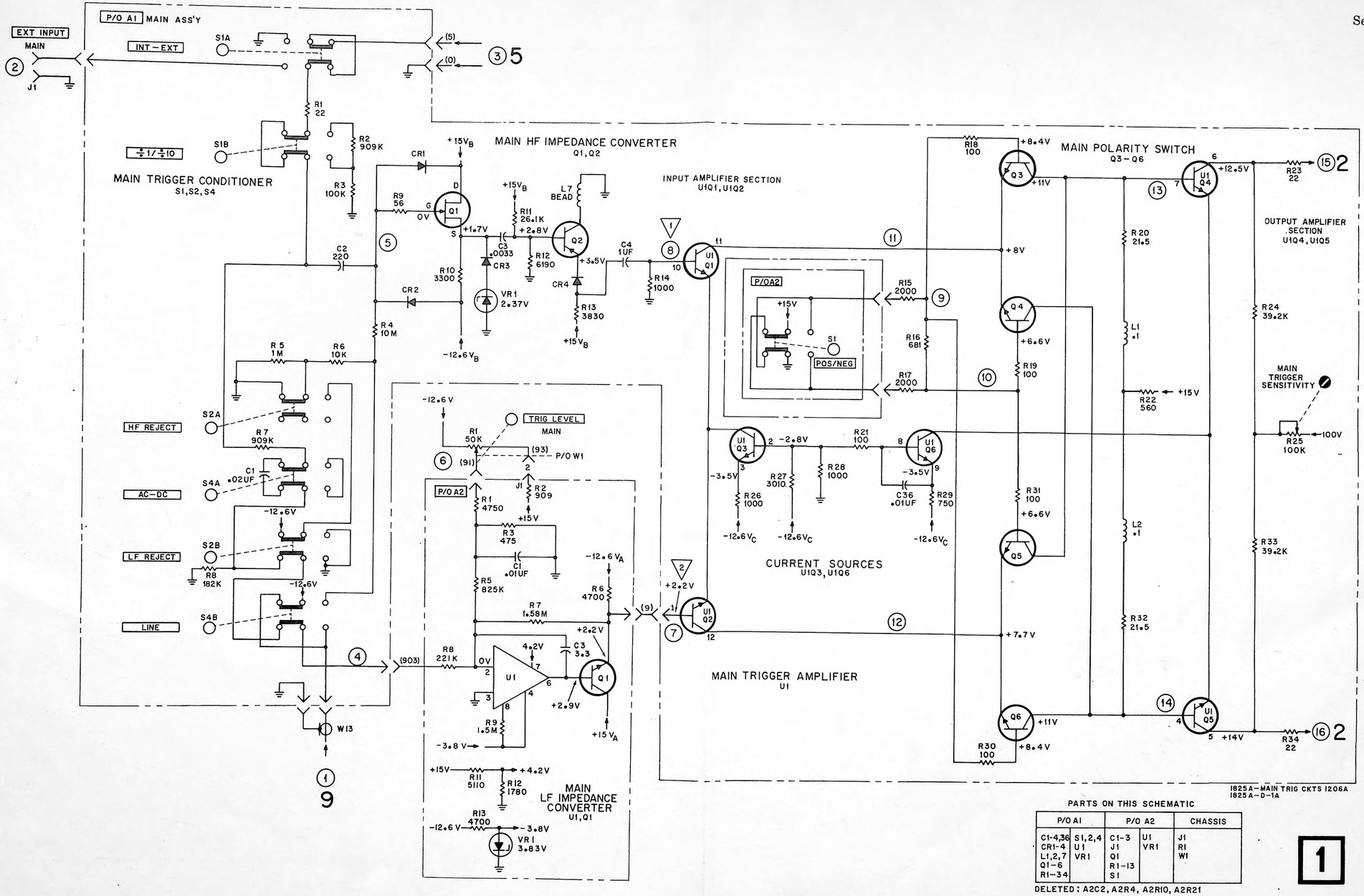


Figure 8-6. Schematic 1 Voltage and Waveform Measurement Conditions

Table 8-4. Schematic 1 Signal Identifier

No.	Signal Name
1	Line trigger
2	Main external trigger
3	Main internal trigger
4	Main trigger input, LF impedance converter
5	Main trigger input, HF impedance converter
6	Main trigger level voltage
7	Main trigger output, LF impedance converter
8	Main trigger output, HF impedance converter
9	Polarity switch control voltage
10	Polarity switch control voltage
11	Main polarity switch input
12	Main polarity switch input
13	Main polarity switch output
14	Main polarity switch output
15	Main trigger amplifier positive output
16	Main trigger amplifier negative output

trigger
trigger
nput, LF impedance converter
nput, HF impedance converter
evel voltage
utput, LF impedance converter
utput, HF impedance converter
h control voltage
h control voltage
switch input
switch input
switch output
switch output
mplifier positive output
mplifier negative output



PARTS ON THIS SCHEMATIC

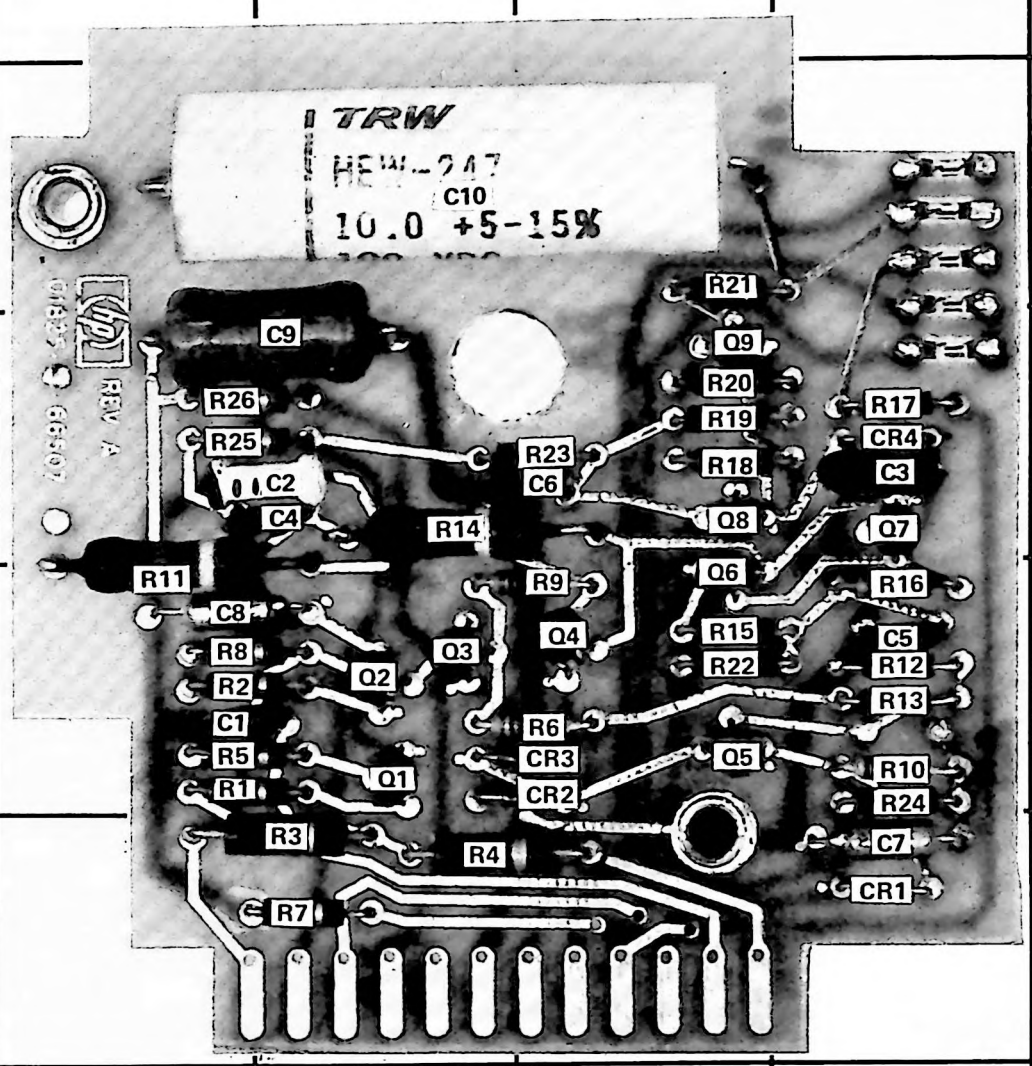
P/O A1		P/O A2		CHASSIS
C1-4,36	S1,2,4	C1-3	U1	J1
CR1-4	U1	J1	VR1	R1
L1,2,7	VR1	Q1		W1
Q1-6		R1-13		
R1-34		S1		

DELETED: A2C2, A2R4, A2R10, A2R21

1

Figure 8-7.
Schematic, Main Trigger Circuits

	A	B	C	D	E	F	
1							1
2							2
3							3
4							4
5							5
6			A7				6



Circuit boards have plated through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-4	CR1	E-5	Q7	E-3	R7	C-5	R17	E-3
C2	C-3	CR2	D-4	Q8	D-3	R8	B-4	R18	D-3
C3	E-3	CR3	D-4	Q9	D-3	R9	D-4	R19	D-3
C4	C-3	CR4	E-3	Q10		R10	E-4	R20	D-3
C5	E-4	Q1	C-4	R1	B-4	R11	B-4	R21	D-2
C6	D-3	Q2	C-4	R2	B-4	R12	E-4	R22	D-4
C7	E-5	Q3	C-4	R3	C-5	R13	E-4	R23	D-3
C8	B-4	Q4	D-4	R4	C-5	R14	C-3	R24	E-4
C9	C-3	Q5	D-4	R5	B-4	R15	D-4	R25	B-3
C10	C-2	Q6	D-4	R6	D-4	R16	E-4	R26	B-3

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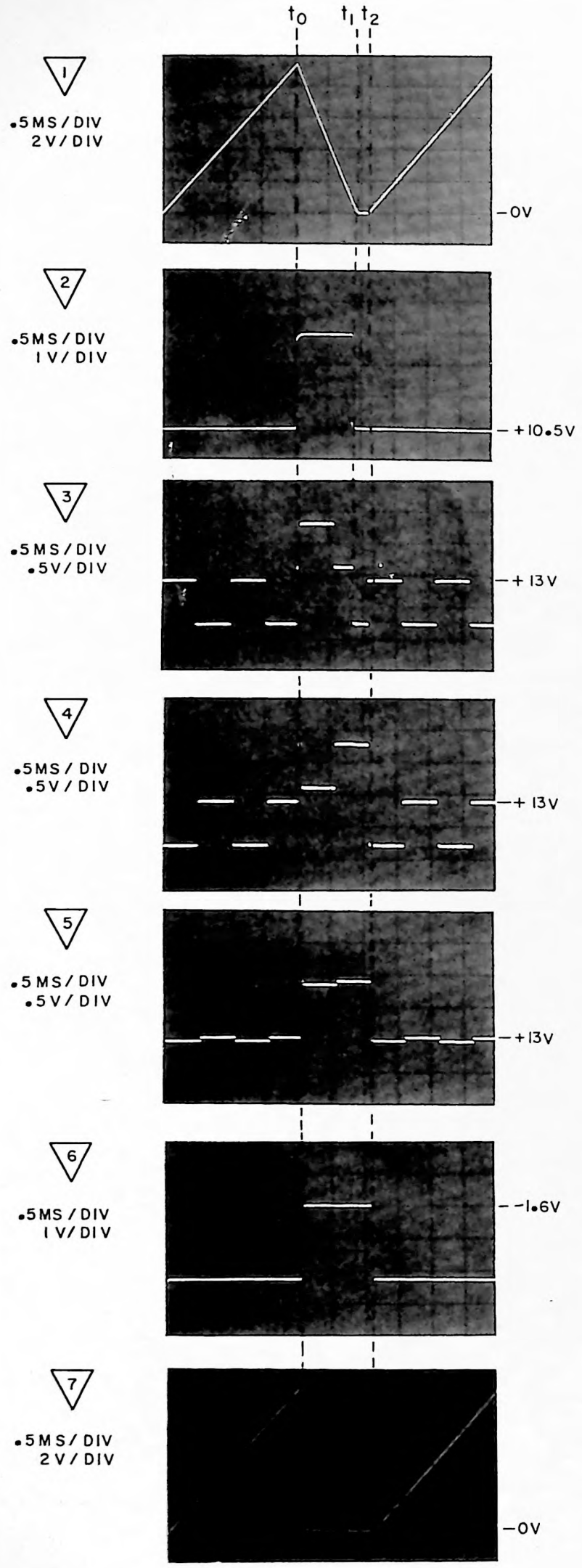
Figure 8-8. A7 Components Locator



VOLTAGE MEASUREMENT CONDITIONS

Set Model 1825A controls as follows:

DISPLAY	MAIN
MAIN TIME/DIV	.2 mSEC
DELAYED TIME/DIV	OFF
MAIN TRIG LEVEL	cw
VERNIER	detent
AUTO/NORM	NORM
SINGLE	in
pushbuttons not mentioned	out

Press RESET and observe that RESET lamp is on. During each test, ensure that RESET lamp is on.

WAVEFORM MEASUREMENT CONDITIONS

Connect equipment as shown in figure 8-3.

Set Model 1825A controls as follows:

DISPLAY	MAIN
MAIN TIME/DIV	.2 mSEC
DELAYED TIME/DIV	OFF
MAIN POS/NEG	NEG
AUTO/NORM	NORM
MAIN INT/EXT	EXT
MAIN ÷1/÷10	÷10
pushbuttons not mentioned	out

WAVEFORM NOTES

At t_0, sweep ends; holdoff starts; 10V Schmitt sets high.

At t_1, holdoff ends; 10V Schmitt resets low; dual Schmitt arms.

At t_2, dual Schmitt output goes low; integrator gate initiates trigger step to integrator; sweep starts.

1825A-R-11

Figure 8-9. Schematic 2 Voltage and Waveform Measurement Conditions

Table 8-5. Schematic 2 Signal Identifier

No.	Signal Name
15	Main trigger amplifier positive output
16	Main trigger amplifier negative output
17	Single sweep control voltage
18	Main trigger enable control voltage
19	Free-run trigger
20	Free-run enable voltage
21	Main dual Schmitt output
22	Auto and lockout output
23	Internal display enable voltage
24	Main gate to rear panel
25	Main integrator gate
25A	Main gate to gate Schmitt
26	Holdoff control voltage
27	Holdoff ramp
28	Main feedback ramp
29	Main ramp to rear panel
31	Main integrator input
32	Main ramp to comparator
33	Main ramp output

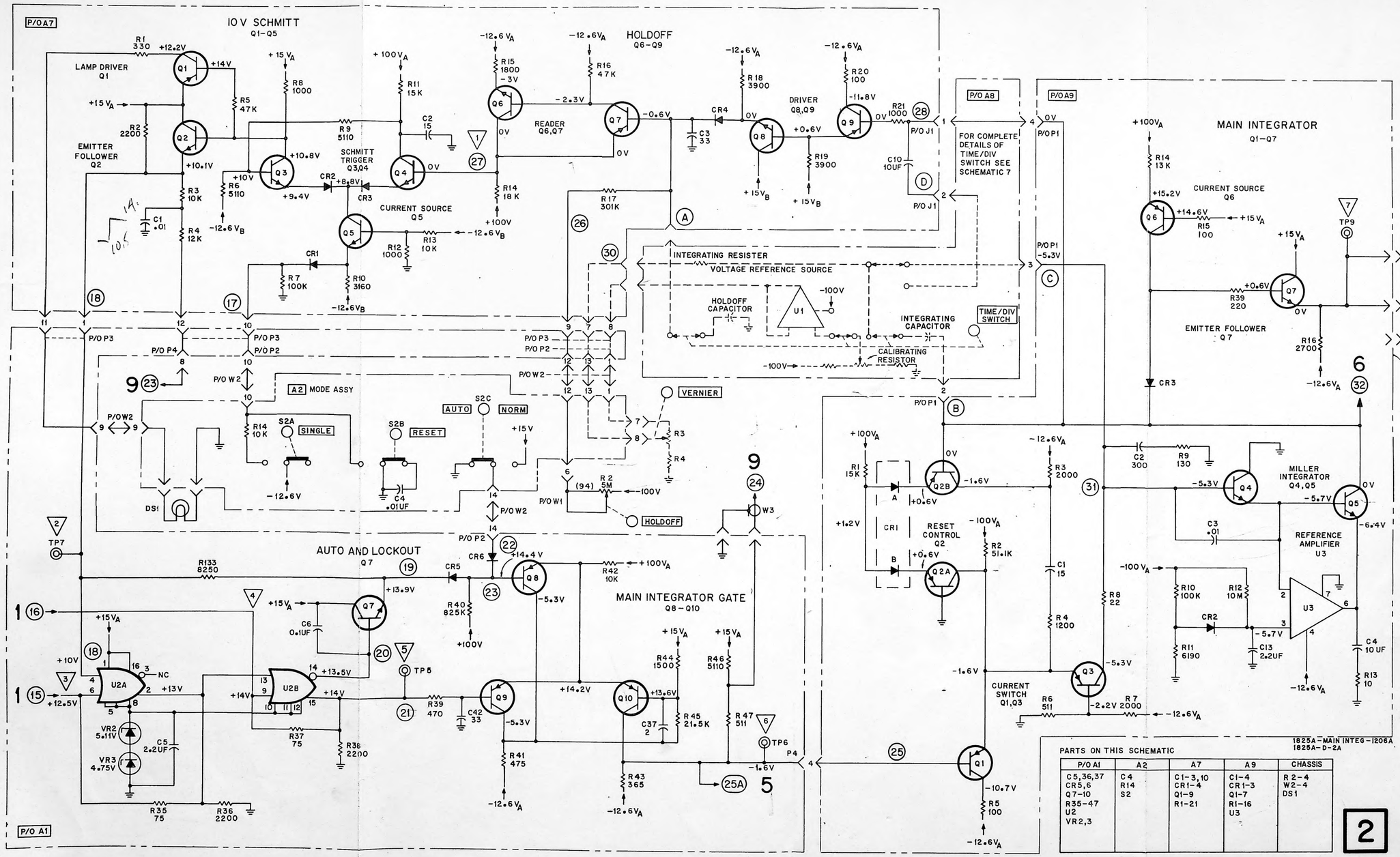
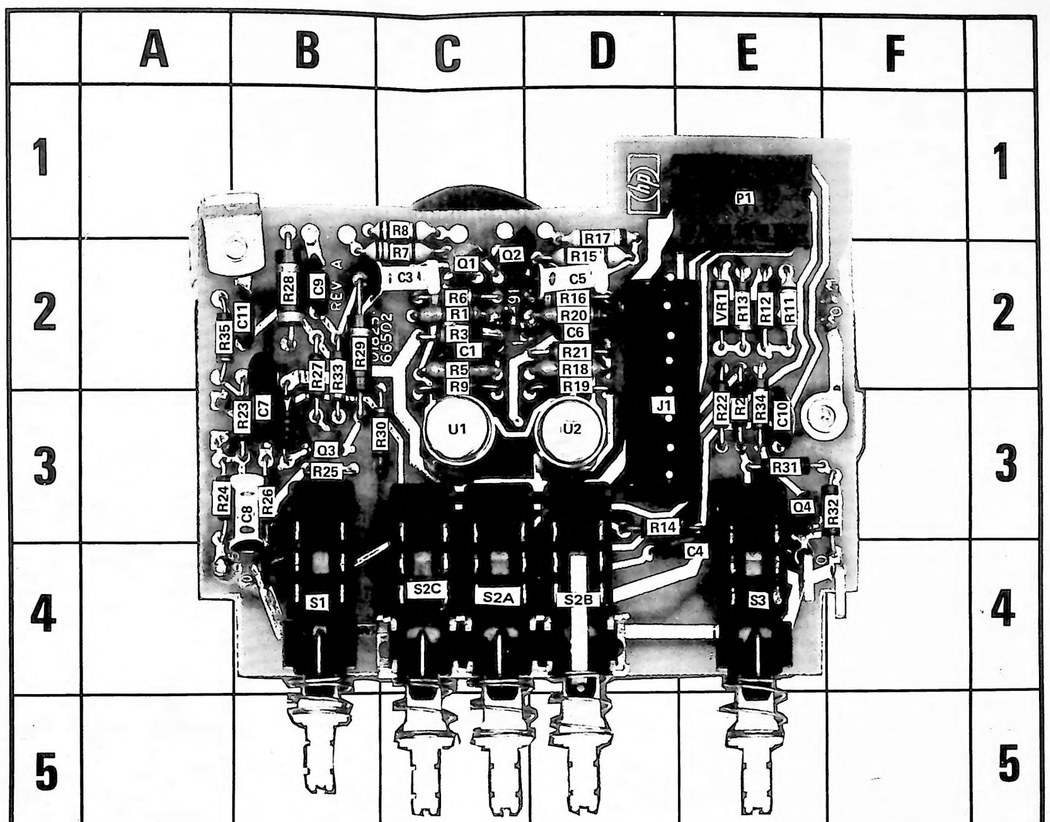


Figure 8-10.
Schematic, Main Integrator
8-11



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-2	Q1	C-2	R11	E-2	R22	E-3	R33	B-2
C3	C-2	Q2	C-2	R12	E-2	R23	B-3	R34	E-3
C4	E-4	Q3	B-3	R13	E-2	R24	A-2	R35	A-2
C5	D-2	Q4	E-3	R14	D-3	R25	B-3	S1	B-4
C6	D-2	R1	C-2	R15	D-2	R26	B-3	S2A	C-4
C7	B-3	R2	E-3	R16	D-2	R27	B-2	S2B	D-4
C8	B-3	R3	C-2	R17	D-1	R28	B-2	S2C	C-4
C9	B-2	R5	C-2	R18	D-2	R29	B-2	S3	E-4
C10	E-3	R6	C-2	R19	D-2	R30	C-3	U1	C-3
C11	B-2	R7	C-2	R20	D-2	R31	E-3	U2	D-3
J1	D-3	R8	C-1	R21	D-2	R32	F-3	VR1	E-2
P1	E-1	R9	C-2						

1825A-R-12

Figure 8-11. A2 Components Locator

VOLTAGE MEASUREMENT CONDITIONS

Set Model 1825A controls as follows:

DISPLAY	DELAYED
MAIN TIME/DIV	.2 mSEC
DELAYED TIME/DIV	.1 mSEC
MAIN TRIG LEVEL	cw
DELAYED TRIG LEVEL	cw
VERNIER	detent
AUTO/NORM	NORM
SINGLE	in
pushbuttons not mentioned	out

Press RESET and observe that RESET lamp is on. During each test, ensure that RESET lamp is on.

WAVEFORM MEASUREMENT CONDITIONS

Connect equipment as shown in figure 8-3.

Set Model 1825A controls as follows:

DISPLAY	DELAYED
MAIN TIME/DIV	.2 mSEC
DELAYED TIME/DIV	.2 mSEC
MAIN POS/NEG	NEG
DELAYED POS/NEG	NEG
MAIN INT/EXT	EXT
DELAYED INT/EXT	EXT
MAIN ÷1/÷10	÷10
DELAYED ÷1/÷10	÷10
DELAY dial	ccw
pushbuttons not mentioned	out

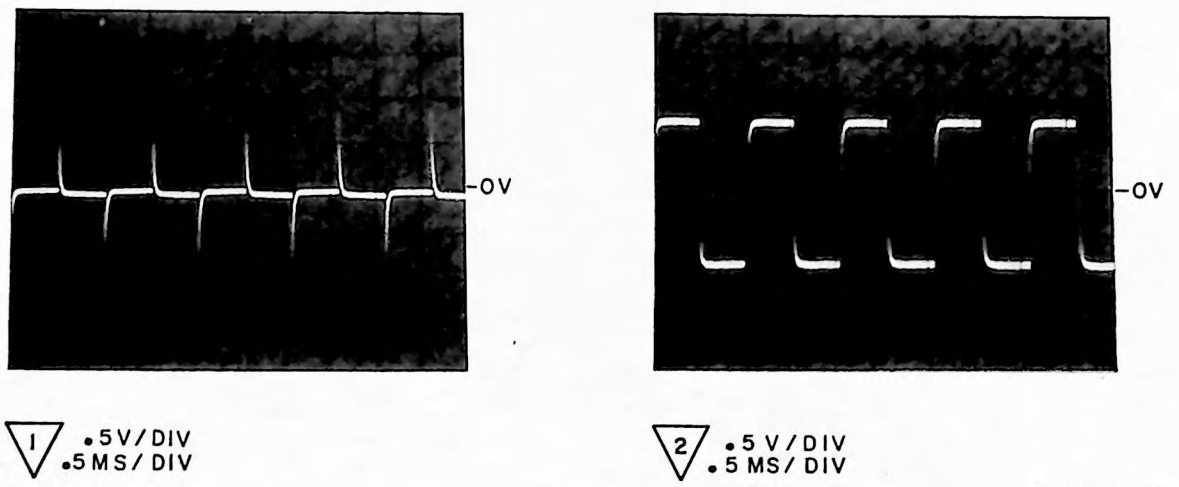
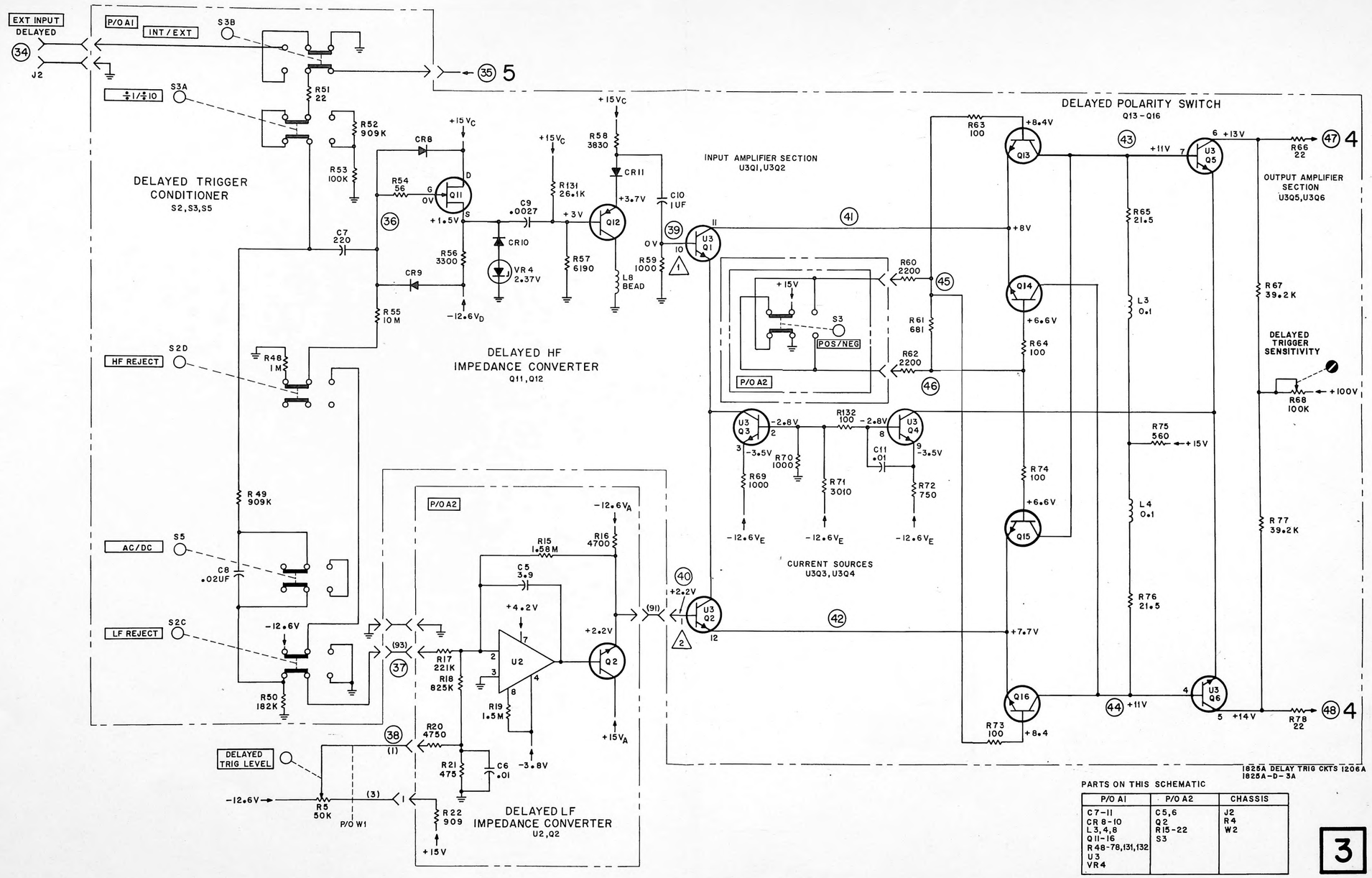


Figure 8-12. Schematic 3 Voltage and Waveform Measurement Conditions

Table 8-6. Schematic 3 Signal Identifier

No.	Signal Name
34	Delayed external trigger
35	Delayed internal trigger
36	Delayed trigger input, HF inpedance converter
37	Delayed trigger input, LF impedance converter
38	Delayed trigger level voltage
39	Delayed trigger output, HF impedance converter
40	Delayed trigger output, LF impedance converter
41	Delayed polarity switch input
42	Delayed polarity switch input
43	Delayed polarity switch output
44	Delayed polarity switch output
45	Delayed polarity switch control voltage
46	Delayed polarity switch control voltage
47	Delayed trigger amplifier, positive output
48	Delayed trigger amplifier, negative output

al trigger
al trigger
r input, HF inpedance converter
r input, LF impedance converter
r level voltage
r output, HF impedance converter
r output, LF impedance converter
ty switch input
ty switch input
ty switch output
ty switch output
ty switch control voltage
ty switch control voltage
r amplifier, positive output
r amplifier, negative output

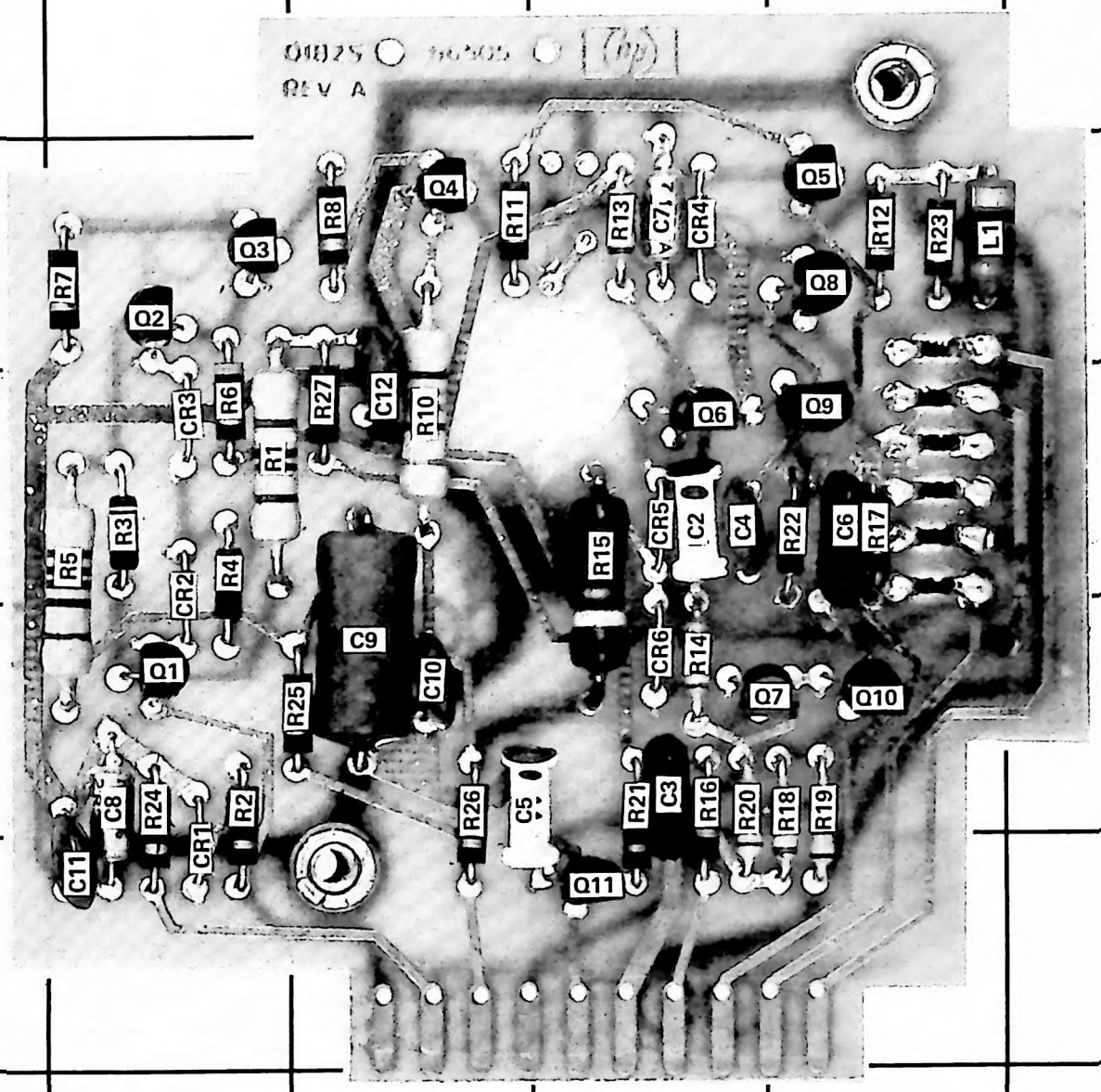


PARTS ON THIS SCHEMATIC

P/O A1	P/O A2	CHASSIS
C7-11 CR 8-10 L3, 4, 8 Q11-16 R48-78, 131, 132 U3 VR4	C5, 6 Q2 R15-22 S3	J2 R4 W2

3

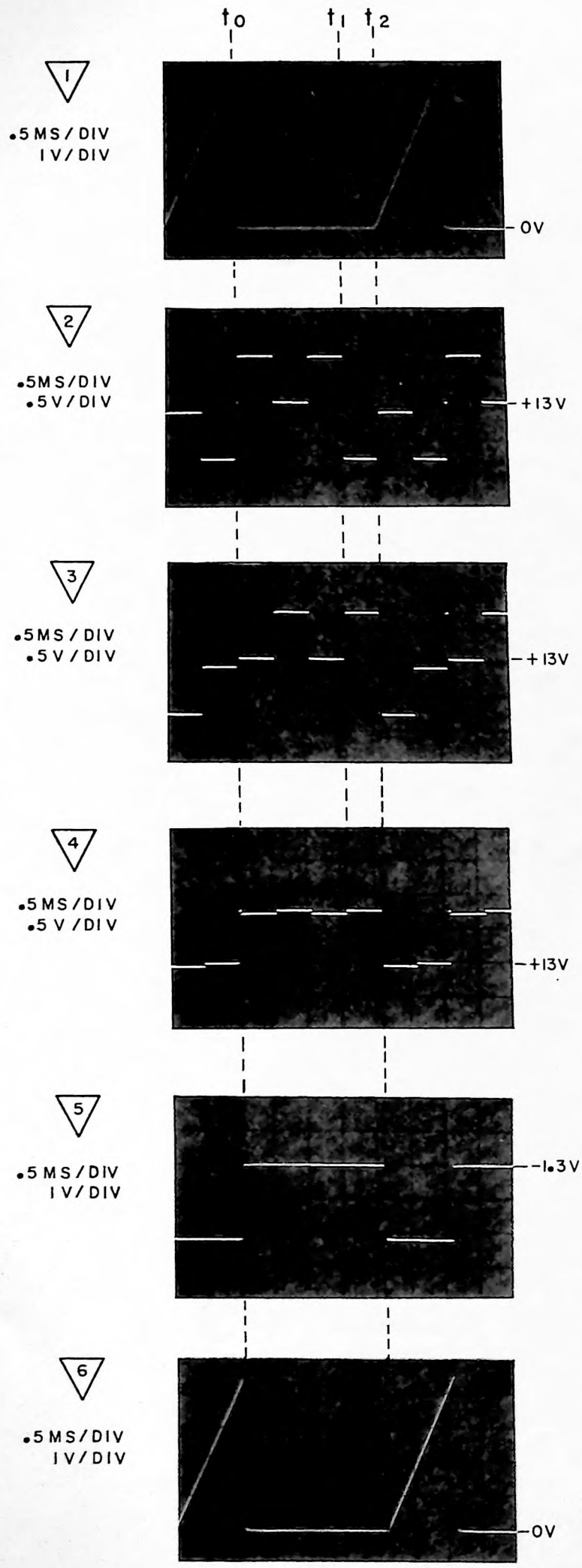
Figure 8-13.
Schematic, Delayed Trigger Circuits



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C2	D-3	CR1	B-5	Q5	E-2	R5	B-3	R17	E-3
C3	D-4	CR2	B-3	Q6	D-3	R6	B-3	R18	E-4
C4	D-4	CR3	B-3	Q7	E-4	R7	B-2	R19	E-4
C5	C-4	CR4	D-2	Q8	E-2	R8	C-2	R20	D-4
C6	E-3	CR5	D-3	Q9	E-3	R10	C-3	R21	D-4
C7	D-2	CR6	D-4	Q10	E-4	R11	C-2	R22	E-3
C8	B-4	L1	E-2	Q11	D-5	R12	E-2	R23	E-2
C9	C-4	Q1	B-4	R1	B-3	R13	D-2	R24	B-4
C10	C-4	Q2	B-2	R2	B-4	R14	D-4	R25	C-4
C11	B-5	Q3	B-3	R3	B-3	R15	D-3	R26	C-4
C12	C-3	Q4	C-2	R4	B-3	R16	D-4	R27	C-3

1825A-R-20

Figure 8-14. A5 Components Locator



VOLTAGE MEASUREMENT CONDITIONS

Set Model 1825A controls as follows:

DISPLAY	DELAYED
MAIN TIME/DIV	.2 mSEC
DELAYED TIME/DIV	.1 mSEC
MAIN TRIG LEVEL	cw
DELAYED TRIG LEVEL	cw
VERNIER	detent
AUTO/NORM	NORM
SINGLE	in
pushbuttons not mentioned	out

Press RESET and observe that RESET lamp is on. During each test, ensure that RESET lamp is on.

WAVEFORM MEASUREMENT CONDITIONS

Connect equipment as shown in figure 8-3.

Set Model 1825A controls as follows:

DISPLAY	DELAYED
MAIN TIME/DIV	.2 mSEC
DELAYED TIME/DIV	.2 mSEC
MAIN POS/NEG	NEG
DELAYED POS/NEG	NEG
MAIN INT/EXT	EXT
DELAYED INT/EXT	EXT
MAIN ÷1/÷10	÷10
DELAYED ÷1/÷10	÷10
DELAY dial	ccw
pushbuttons not mentioned	out

WAVEFORM NOTES

At t_0, main sweep ends.

At t_1, comparator coincidence occurs; dual Schmitt arms.

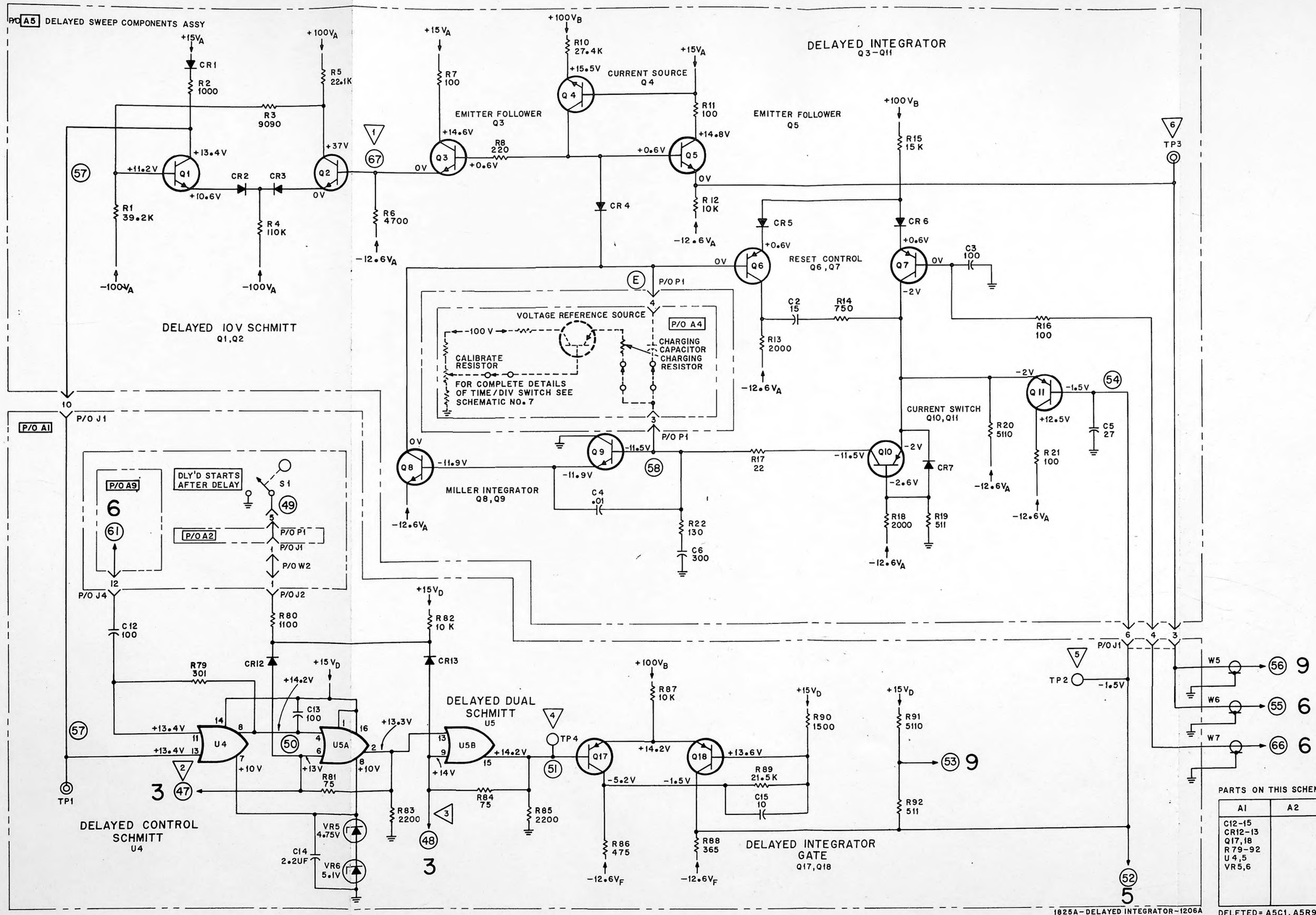
At t_2, dual Schmitt output goes low; integrator gate initiates trigger step to integrator; delayed sweep starts.

1825A - R - 15

Figure 8-15. Schematic 4 Voltage and Waveform Measurement Conditions

Table 8-7. Schematic 4 Signal Identifier

No.	Signal Name
47	Delayed trigger amplifier positive output
48	Delayed trigger amplifier negative output
49	Delayed starts after delay control line
50	Delayed trigger enable voltage
51	Delayed dual Schmitt output
52	Delayed gate to gate Schmitt
53	Delayed gate to rear panel
54	Delayed integrator gate
55	Delayed ramp
56	Delayed ramp to rear panel
57	Delayed control Schmitt enable voltage
58	Delayed integrator input
66	Delayed reset reference voltage
67	Delayed feedback ramp



PARTS ON THIS SCHEMATIC

A1	A2	A5	CHASSIS
C12-15 CR12-13 Q17,18 R79-92 U4,5 VR5,6		C2-6 CR1-7 Q1-11 R1-21,27	S1 W5-7

DELETED= A5C1, A5R9

4

Figure 8-16.
Schematic, Delayed Integrator
8-15/8-16

Table 8-8. Schematic 5 Signal Identifier

No.	Signal Name
3	Main internal trigger
25A	Main gate to gate Schmitt
35	Delayed internal trigger
52	Delayed gate to gate Schmitt
59	Internal trigger input
63	Composite intensified gate
64	Main gate enable voltage
65	Delayed gate enable voltage

VOLTAGE MEASUREMENT CONDITIONS

Connect equipment as shown in figure 8-3.

Set Model 1825A controls as follows:

DISPLAY ..... DELAYED
MAIN/TIME DIV ..... .2 mSEC
DELAYED TIME/DIV ..... .1 MSEC
MAIN TRIG LEVEL ..... cw
DELAYED TRIG LEVEL ..... cw
VERNIER ..... detent
AUTO/NORM ..... NORM
SINGLE ..... in
pushbuttons not mentioned ..... out

Press RESET and observe that RESET lamp is on. During each test, ensure that RESET lamp is on.

Figure 8-17. Schematic 5 Voltage Measurement Conditions

Signal Identifier

e
al trigger
gate Schmitt
rnal trigger
to gate Schmitt
ger input
tensified gate
able voltage
enable voltage

NT CONDITIONS

n figure 8-3.

llows:

..... DELAYED
..... .2 mSEC
..... .1 MSEC
..... cw
..... cw
..... detent
..... NORM
..... in
..... out

t RESET lamp is on.
RESET lamp is on.

Measurement Conditions

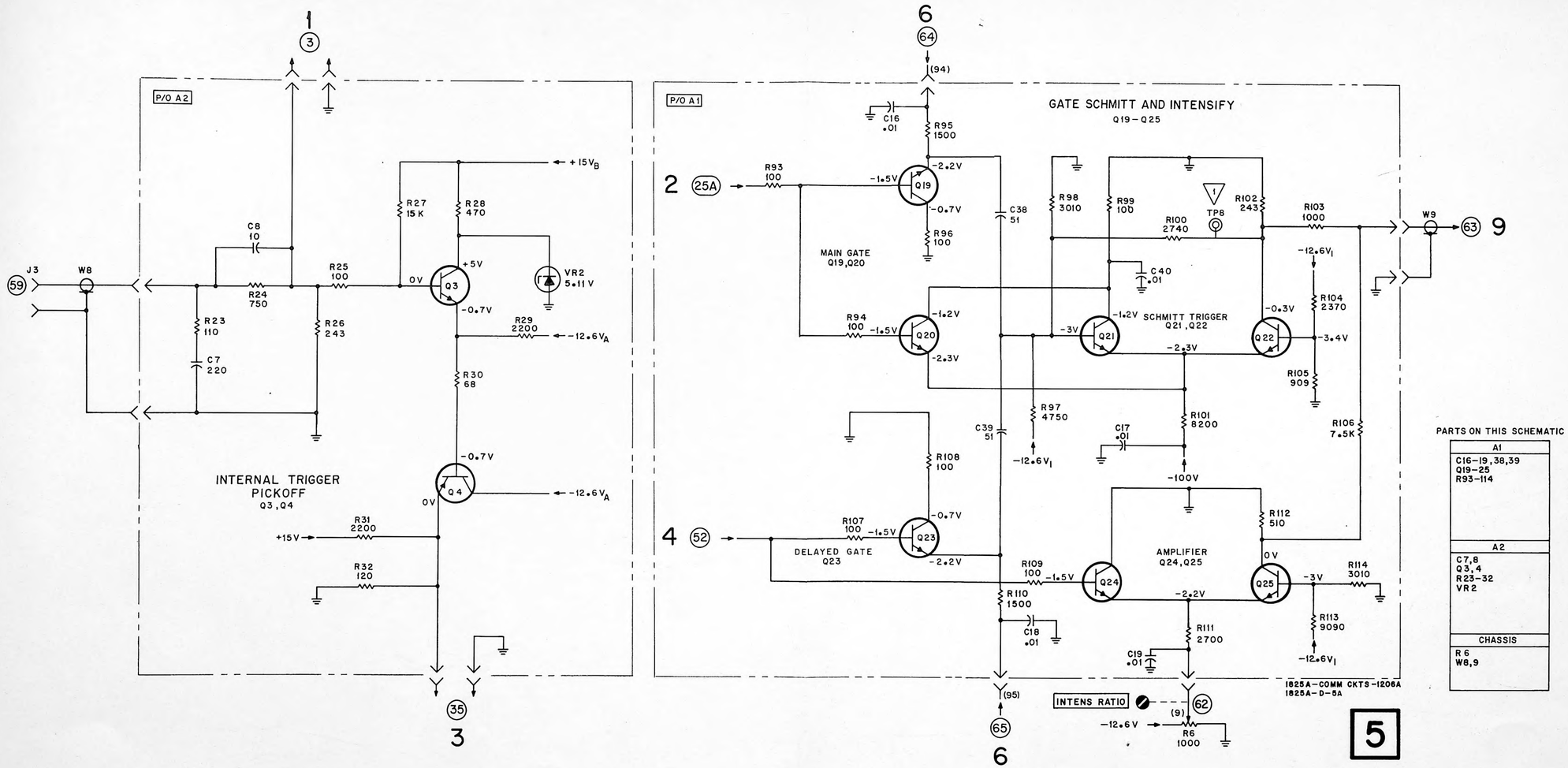
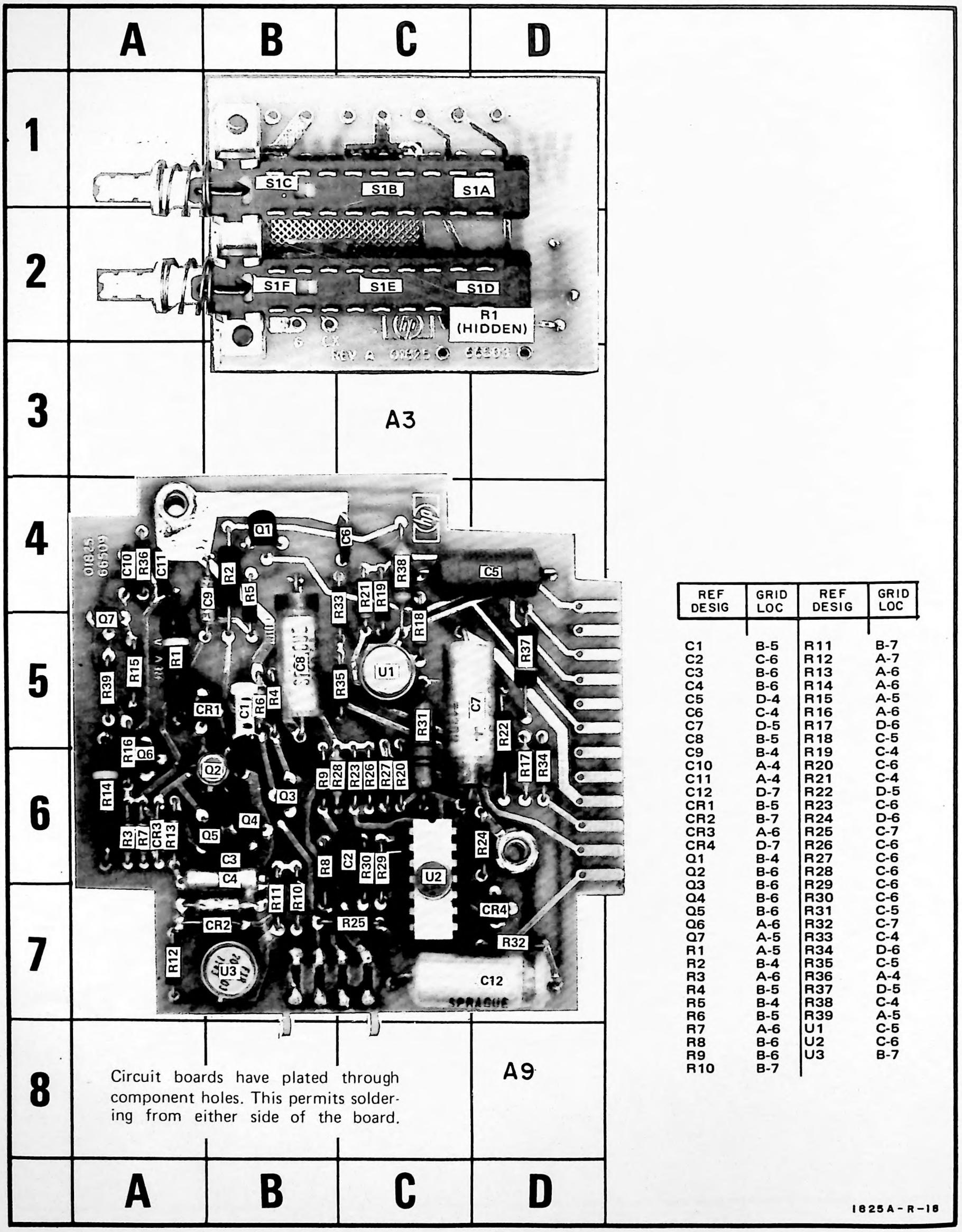


Figure 8-18.
Schematic, Common Circuits 1



REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-5	R11	B-7
C2	C-6	R12	A-7
C3	B-6	R13	A-6
C4	B-6	R14	A-6
C5	D-4	R15	A-5
C6	C-4	R16	A-6
C7	D-5	R17	D-6
C8	B-5	R18	C-5
C9	B-4	R19	C-4
C10	A-4	R20	C-6
C11	A-4	R21	C-4
C12	D-7	R22	D-5
CR1	B-5	R23	C-6
CR2	B-7	R24	D-6
CR3	A-6	R25	C-7
CR4	D-7	R26	C-6
Q1	B-4	R27	C-6
Q2	B-6	R28	C-6
Q3	B-6	R29	C-6
Q4	B-6	R30	C-6
Q5	B-6	R31	C-5
Q6	A-6	R32	C-7
Q7	A-5	R33	C-4
R1	A-5	R34	D-6
R2	B-4	R35	C-5
R3	A-6	R36	A-4
R4	B-5	R37	D-5
R5	B-4	R38	C-4
R6	B-5	R39	A-5
R7	A-6	U1	C-5
R8	B-6	U2	C-6
R9	B-6	U3	B-7
R10	B-7		

Figure 8-19. A3 and A9 Components Locator

Table 8-9. Schematic 6 Signal Identifier

No.	Signal Name
33	Main ramp
55	Delayed ramp
60	Delay comparison voltage
61	Delayed trigger enable voltage
64	Main gate enable voltage
65	Delayed gate enable voltage
66	Delayed reset reference voltage
68	Composite ramp output
69	Delayed enable voltage

VOLTAGE MEASUREMENT CONDITIONS

Connect equipment as shown in figure 8-3.

Set Model 1825A controls as follows:

DISPLAY ..... MIXED
MAIN TIME/DIV ..... .2 mSEC
DELAYED TIME/DIV ..... .1 mSEC
MAIN TRIG LEVEL ..... cw
DELAYED TRIG LEVEL ..... cw
VERNIER ..... detent
AUTO/NORM ..... NORM
SINGLE ..... in
pushbuttons not mentioned ..... out

Press RESET and observe that RESET lamp is on. During each test, ensure that RESET lamp is on.

Figure 8-20. Schematic 6 Voltage Measurement Conditions

nal Identifier

son voltage
r enable voltage
ble voltage
nable voltage
reference voltage
p output
e voltage

T CONDITIONS

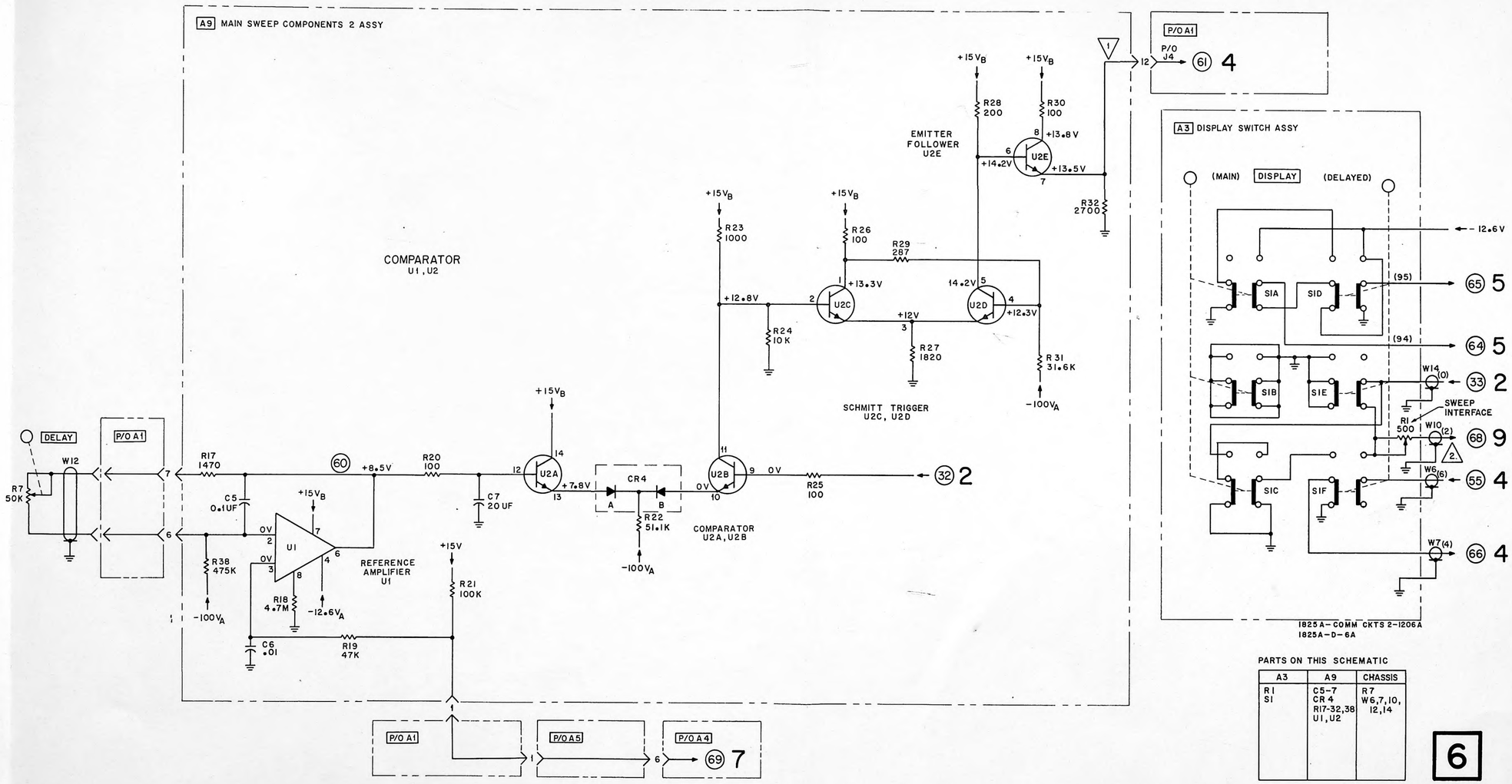
figure 8-3.

ows:

..... MIXED
..... .2 mSEC
..... .1 mSEC
..... cw
..... cw
..... detent
..... NORM
..... in
..... out

RESET lamp is on.
RESET lamp is on.

Measurement Conditions



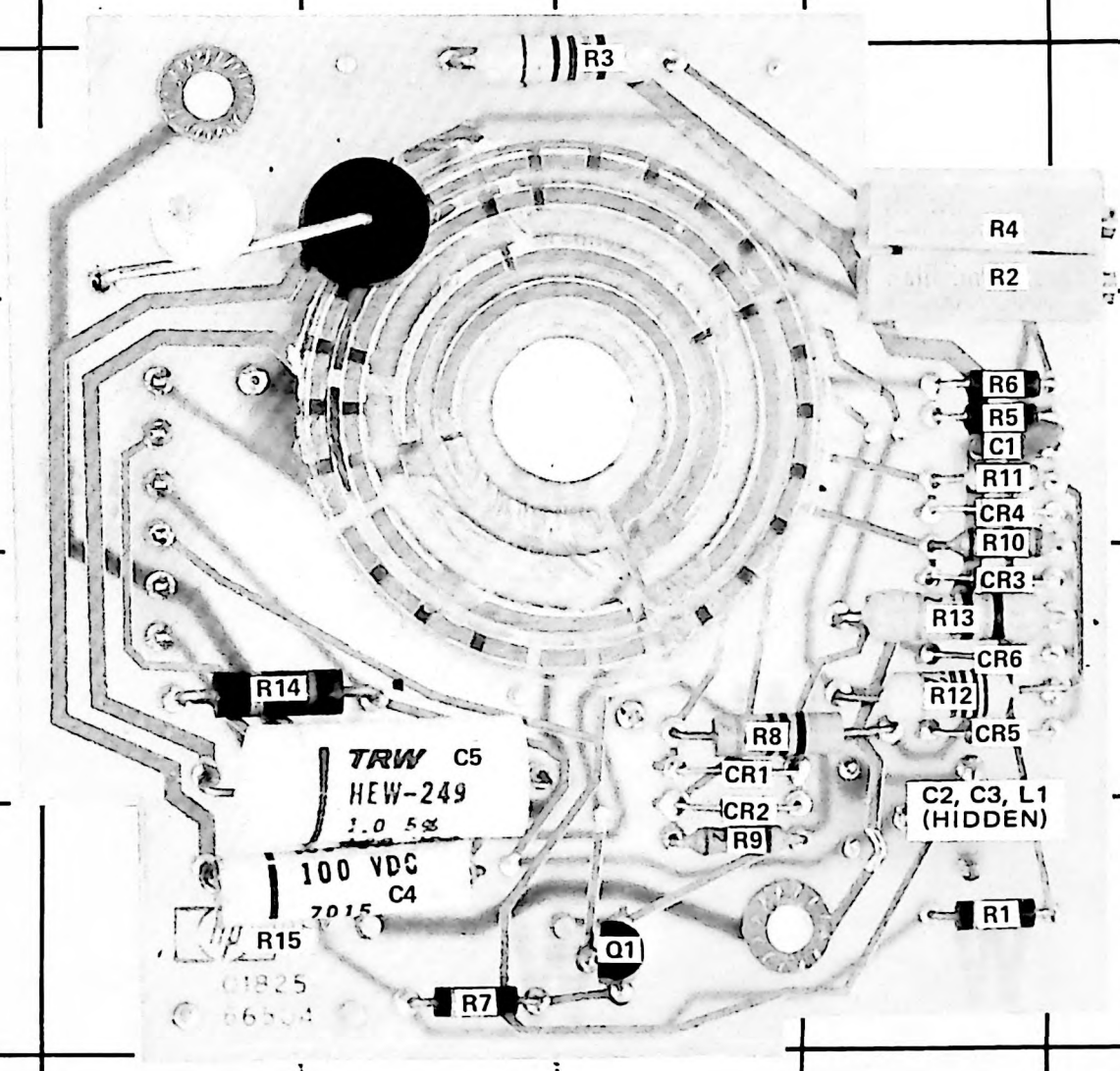
PARTS ON THIS SCHEMATIC

A3	A9	CHASSIS
R1 S1	C5-7 CR4 R17-32,38 U1,U2	R7 W6,7,10, 12,14

6

Figure 8-21.
Schematic, Common Circuits 2

	A	B	C	D	E	F	
1							1
2							2
3							3
4							4
5							5
6							6



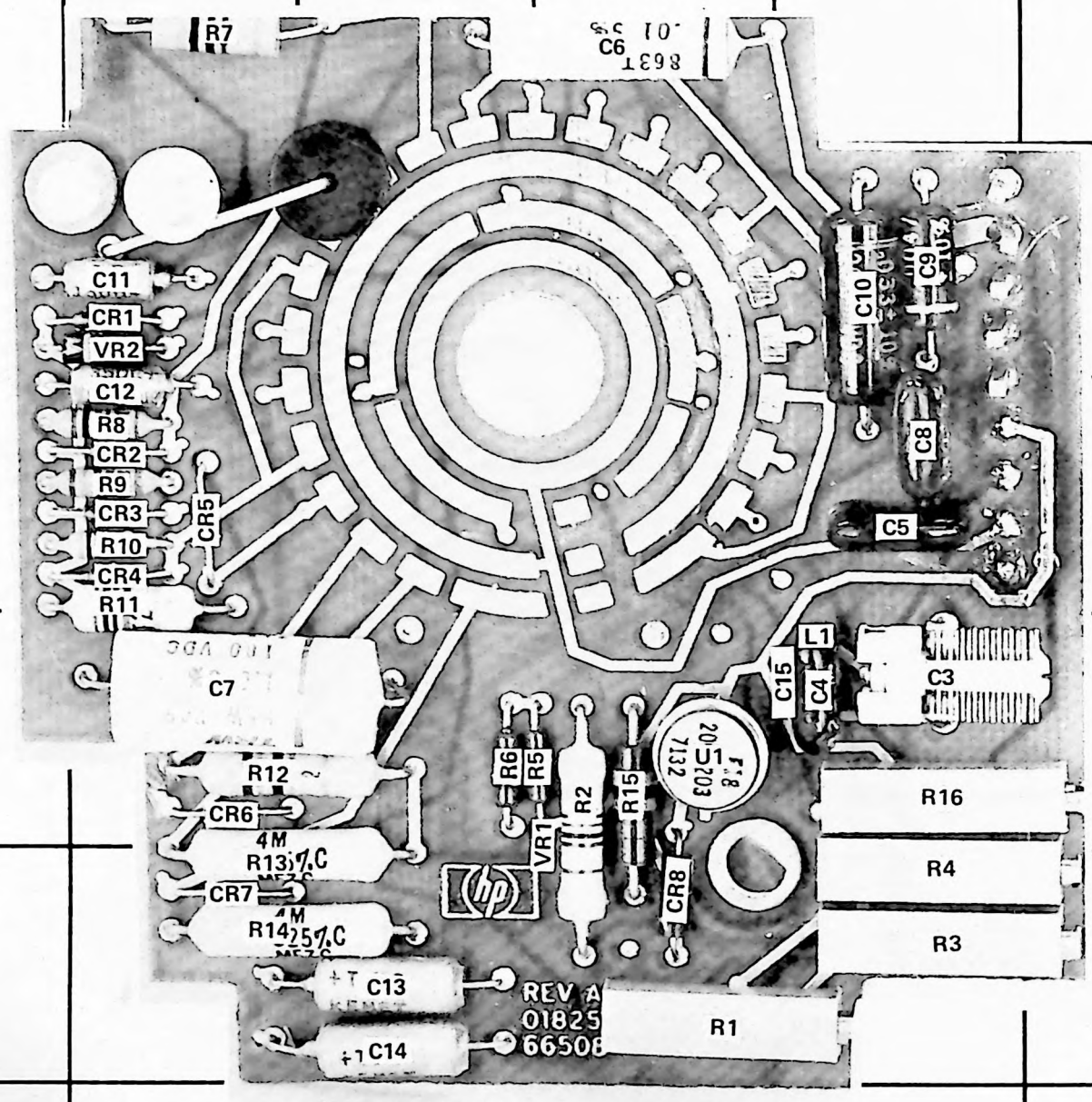
Circuit boards have plated through component holes. This permits soldering from either side of the board.

A4

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-3	CR5	E-4	R6	E-3
C2	E-5	CR6	E-4	R7	C-5
C3	E-5	L1	E-5	R8	D-4
C4	C-5	Q1	D-5	R9	D-5
C5	C-4	R1	E-5	R10	E-3
CR1	D-4	R2	E-2	R11	E-3
CR2	D-5	R3	D-2	R12	E-4
CR3	E-4	R4	E-2	R13	E-4
CR4	E-3	R5	E-3	R14	B-4
				R15	B-5

1825A - R-14A

Figure 8-22. A4 Components Locator



A8

Circuit boards have plated through component holes. This permits soldering from either side of the board.

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C3	E-4	C11	B-2	CR4	B-3	R3	E-5	R11	B-3
C4	E-4	C12	B-3	CR5	B-3	R4	E-5	R12	B-4
C5	E-3	C13	C-5	CR6	B-4	R5	C-4	R13	B-5
C6	D-1	C14	C-5	CR7	B-5	R6	C-4	R14	B-5
C7	B-4	C15	D-4	CR8	D-5	R7	B-1	R15	D-4
C8	E-3	CR1	B-2	L1	E-4	R8	B-3	R16	E-4
C9	E-2	CR2	B-3	R1	D-5	R9	B-3	V1	D-5
C10	E-2	CR3	B-3	R2	D-4	R10	B-3	VR1	D-5
								VR2	B-2

1825A-R-21A

Figure 8-23. A8 Components Locator

Table 8-10. Schematic 7 Signal Identifier

No.	Signal Name
30	Vernier control voltage
31	Main integrator input
32	Main ramp to comparator
58	Delayed integrator input
69	Delayed enable voltage
A	Holdoff interconnection
B	Main integrator output interconnection
C	Main integrator input interconnection
D	Capacitor A7C10 interconnection
E	Delayed integrator output interconnection

DELAYED TIME / DIV MAIN

A4 DELAYED SWITCH ASSY

A8 MAIN SWITCH ASSY

S1A S1B S1C S1D

OFF

C1 .01UF

R1 220

-100V

R2 20K

R3 24.3K

R4 20K

R5 10K

R6 10K

R7 220

R8 40K

R9 80K

R10 160K

R11 400K

R12 800K

R13 1.6M

R15 39K

C2 86

L1 BEAD

C3 1.9-15.7

C4 .01UF

C5 1 UF

R14 18

CR1 CR2 CR3 CR4 CR5 CR6

-12.6V

Q1

VOLTAGE REFERENCE SOURCE Q1

E 4 C 2

6 69 6

58 4

-100VF$_A$

R16 20K

R17 20K

R18 15K

R19 20K

R20 10K

R21 10K

C6 .01UF

C7 1UF

C8 330

C9 4700

C10 .033UF

C11 .33UF

C12 .47UF

C13 4.7UF

C14 22UF

C4 82

C5 910

05

R7 40K

R8 80K

R9 160K

R10 400K

R11 800K

R12 1.6M

R13 4M

R14 4M

CR1 CR2 CR3 CR4 CR5 CR6 CR7

VR2 8.2V

-100VF

31

VR1 30.1V

U1

NC 8 NC 5 4 6 2 3 1 7

C15 30

CR8

R15 22K

VOLTAGE REFERENCE SOURCE U1

P/O A9

-100V$_A$

-100V$_A$

A7 A1 W2 A2

W1 W1 30

R8 39K

D 2

DS2

UNCAL

R3 15K

S2

R4 8200

-100V

A

B

PARTS

A4

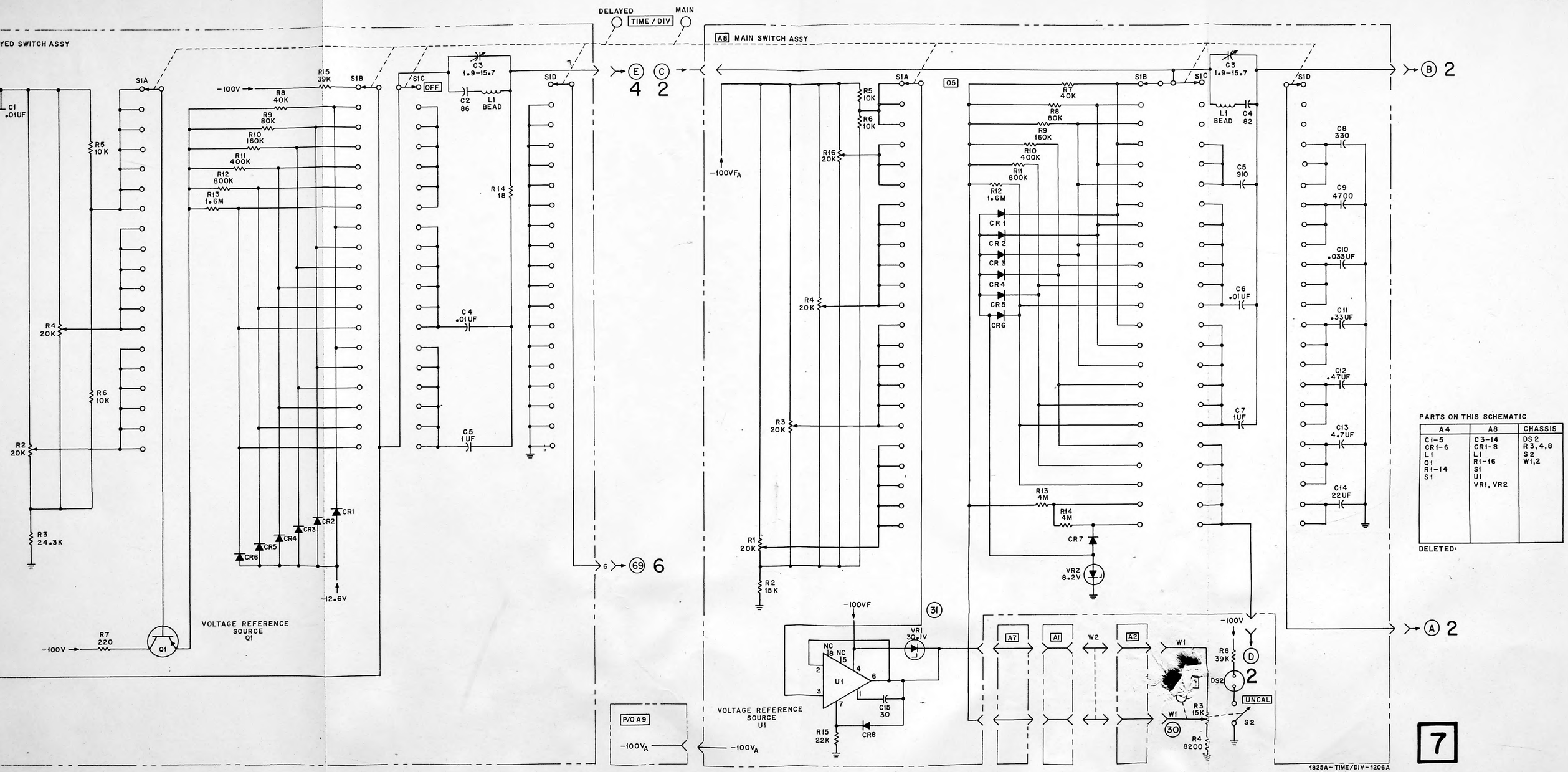
C1-5
CR1-6
L1
Q1
R1-14
S1

DELETE

7

1825A-TIME/DIV-1206A
1825A-E-1B

Schemati

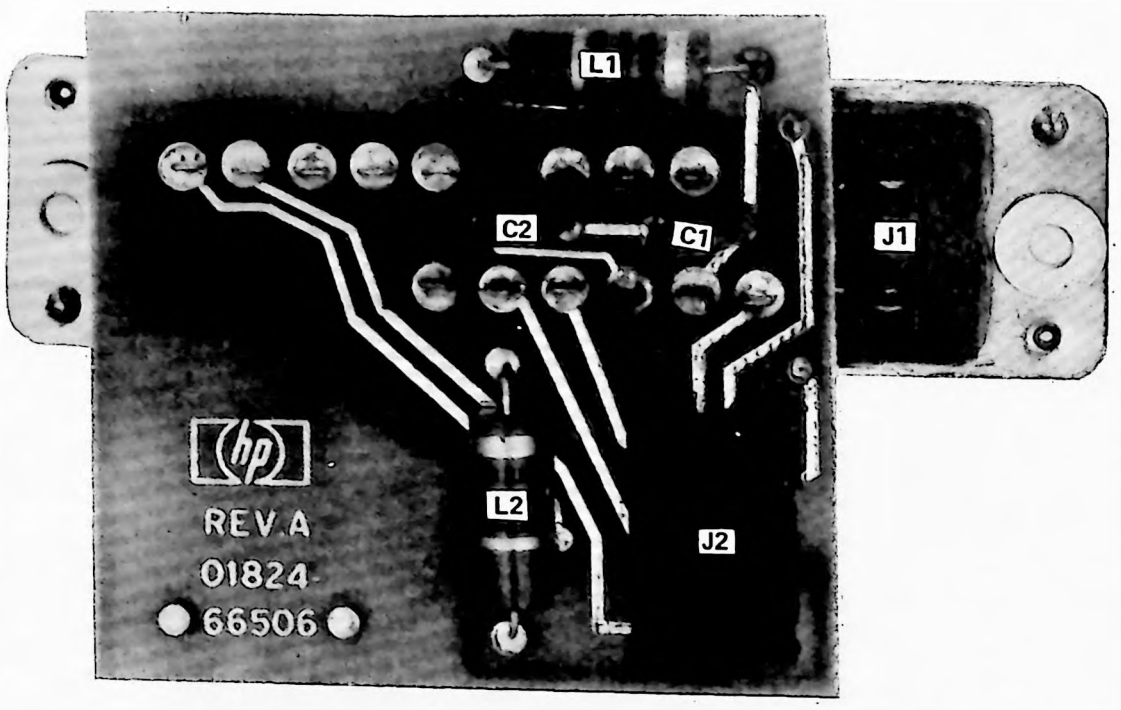


PARTS ON THIS SCHEMATIC

A4	A8	CHASSIS
C1-5	C3-14	DS 2
CR1-6	CR1-8	R 3,4,8
L1	L1	S 2
Q1	R1-16	W1,2
R1-14	S1	
S1	U1	
	VR1, VR2	

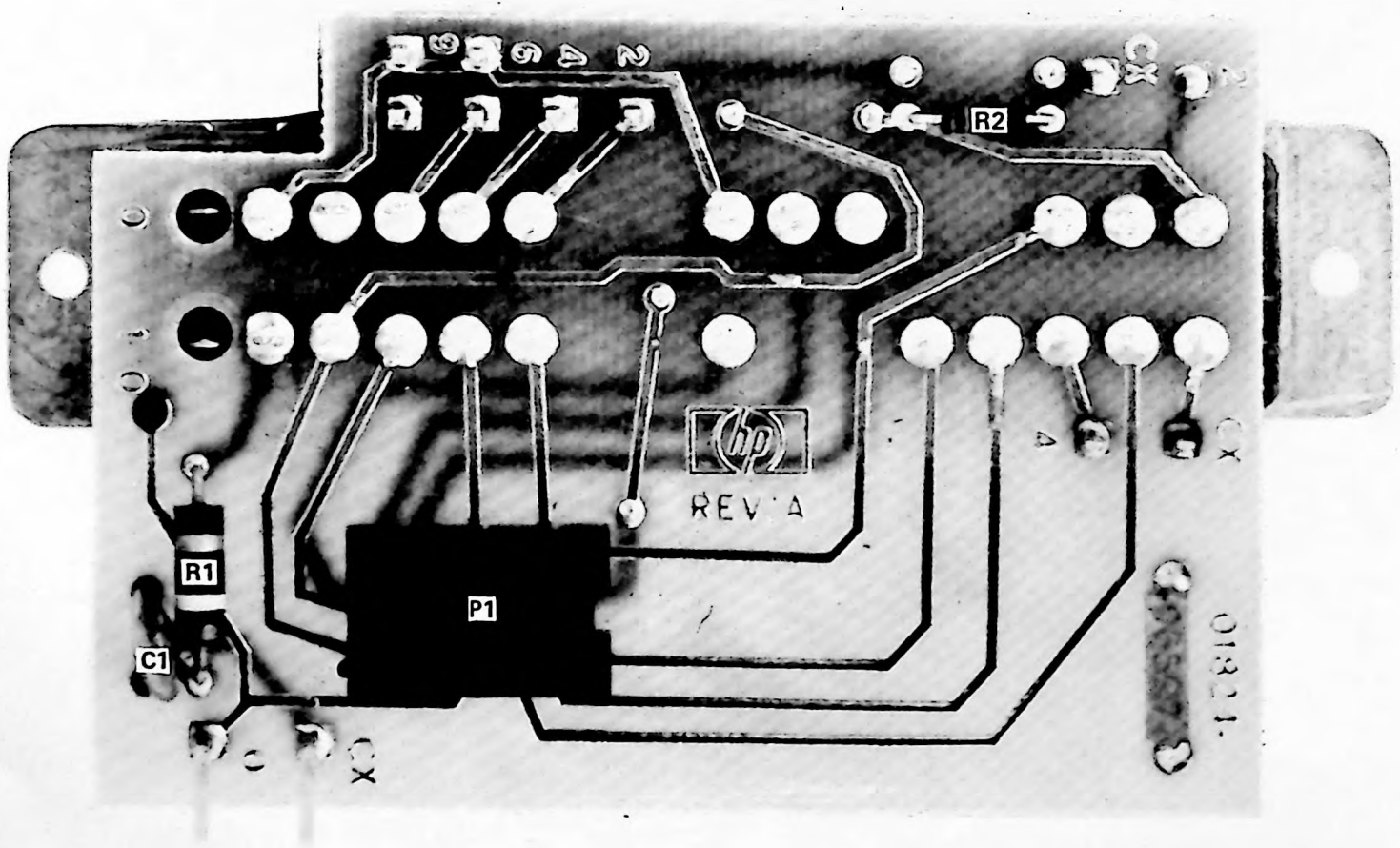
DELETED

Figure 8-24.
Schematic, TIME/DIV Switches
8-21



Circuit boards have plated through component holes. This permits soldering from either side of the board.

A6



A10

Circuit boards have plated through component holes. This permits soldering from either side of the board.

1825A-R-22

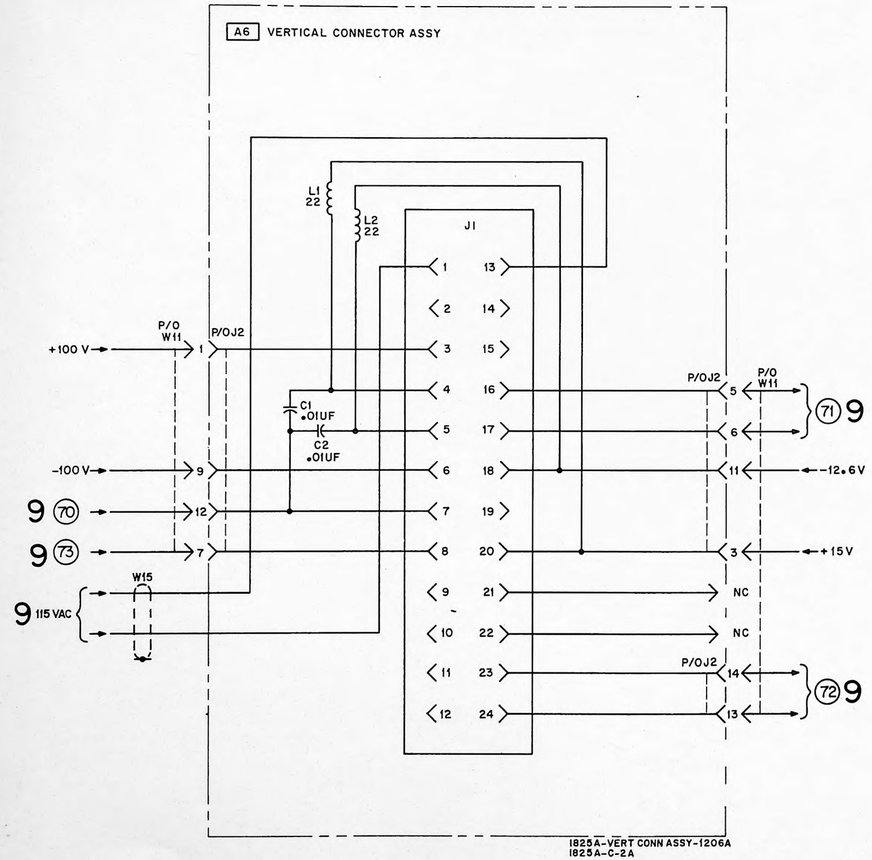
Figure 8-25. A6 and A10 Components Locator

Table 8-11. Schematics 8 and 9 Signal Identifier

No.	Signal Name
1	Line trigger
24	Main gate to rear panel
29	Main ramp to rear panel
53	Delayed gate to rear panel
56	Delayed ramp to rear panel
63	Composite intensified gate
68	Composite ramp output
70	Beam finder
71	Chopped blanking
72	Alternate trigger

ignal Identifier

panel
ur panel
ear panel
rear panel
ified gate
output
r

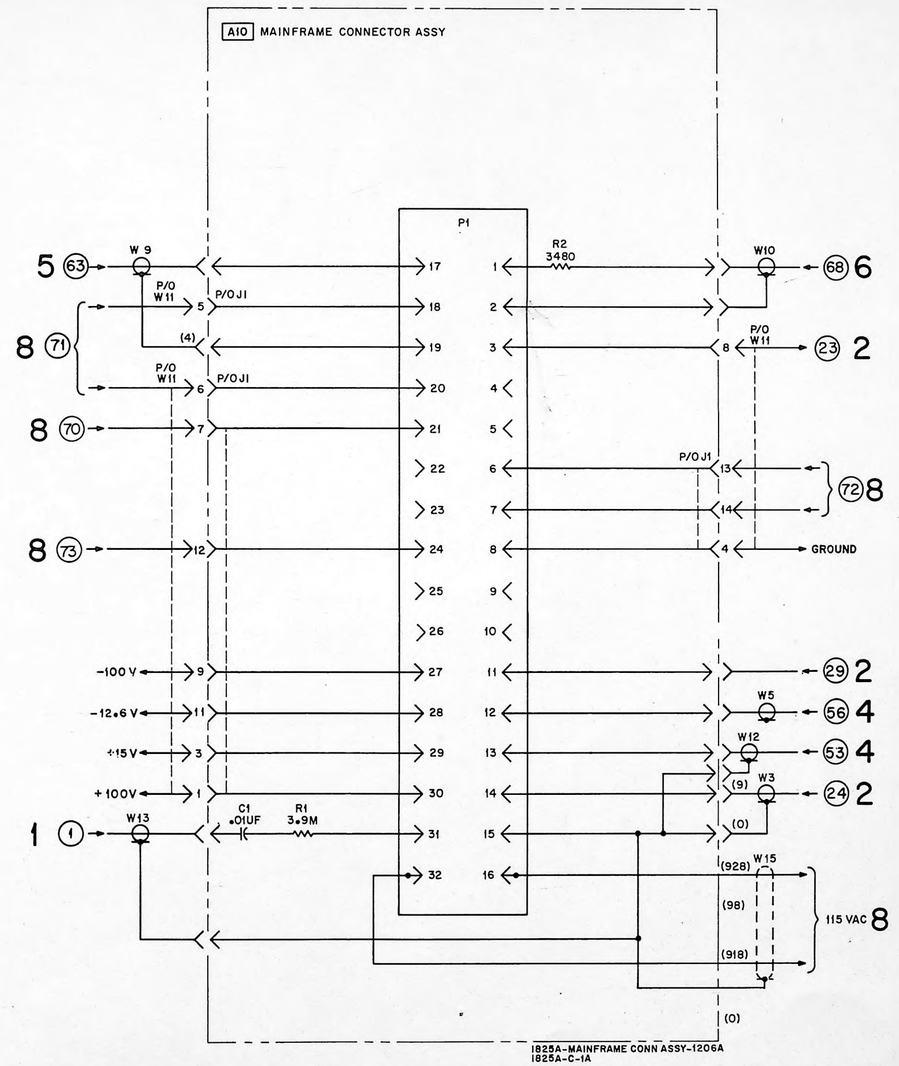


PARTS ON THIS SCHEMATIC

A6	CHASSIS
C1,2 J1,2 L1,2	W11,15

8

Figure 8-26. Schematic, Vertical Connector Assembly



PARTS ON THIS SCHEMATIC

A10	CHASSIS
C1 J1 P1 R1,2	W3,5,10-15

9

Figure 8-27.
Schematic, Mainframe Connector Assembly

PARTS ON THIS SCHEMATIC

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	CHASSIS
C20-35 L5,6 R115-130	C9-11 R33-35			C7-12 R25-27		C4,9 R22,26		C8-12 R33,37		W1,2,11

DELETED: A1C27, A1C33, A1R21, A1R22, A1R28

Figure 8-28. Schematic, DC Voltage Distribution

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